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Is there something like bio-dynamic breeding?

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1. Introduction

Bio-dynamics is a practical result out of the anthroposophical worldview. Crucial elements of anthroposophy are *spirituality* as an additional aspect to the physical world (inner relationship between the observed physical world and the spiritual world in it ('it is the spirit that sets the world in motion'), the *specific view on evolution* (crucial role of man in the world and not man as a coincidence; the inner relationship between the world of rocks, plants, animals and man: see Bolk, 1932; Schad, 1971; Verhulst, 1999) and human *karma and reincarnation*. Based on this thoughts, bio-dynamics developed its own way to judge about relationships in the physical world (for instance the threefoldness of the body and of mammals), used its own language to express the holistic approach in agriculture (for instance the farm as a living organism) and focused on additional relationships within the world (for instance the stars and the moon in relation to plant growth as 'soft' forces additionally to physical and chemical forces; plant gestures in relation to illnesses and diseases). Plants and animals are experienced as beings, which affect our contacts and association with them. Recently a discussion on organic breeding was done in The Netherlands (Nauta et al., 2002). Earlier Spengler (1997) described the specific attentions in bio-dynamic cattle breeding.
In this paper the differentiation made within the concept of naturalness (Verhoog et al., 2002, 2003) will be used to explain the different approaches in breeding within the organic movement. The differentiation of the concept will result into a framework, which will be used as a tool to describe and explain the elements of bio-dynamic animal breeding.

2. Naturalness explained

Based on the concept and definition of naturalness, which have been investigated by Verhoog et al. (2002, 2003), it became clear that a conversion to organic farming is experienced as a paradigmatical change. Verhoog et al. (2002) found three additional explanations of the concept of 'being natural or naturalness'. These three approaches can explain the different scopes and ideals which can be found within the organic movement as a whole. This differentiation has been found a very helpful tool in the discussion about the future of organic farming, its goals and its blood groups. Firstly, naturalness will be described from several points of view.

2.1. Naturalness as a result of the discussion about dead or living nature

As a first step in conversion farmers ask for alternative remedies for their on-farm problems. Artificial fertilisers, pesticides and herbicides no longer can be used. The focus of the farmer is still problem and symptom oriented when he asks for 'organically accepted replacements' (Bloksma, 1991). The background of banning artificially produced materials is a negative approach, which came up very strongly in the 1960s. The impressive book 'Silent Spring' was

written by Rachel Carson (1963), who opened the world's eyes on the long term effects of the highly persistent pesticides (aldrins, dieldrin, DDT, etc). However, earlier organic farmers were already negative about the effects of the first artificial fertilisers. Farmers found out that due to the introduction of fertilisers (since 1860) the fertility of their cattle was reducing and the maintenance of their own seeds became more difficult. This was the start of the biodynamic movement in the 1920s, when farmers asked Rudolf Steiner to explain to them his esoterical ideas about agriculture (Steiner, 1924). It were these negative experiences in the early 1920s which gave the basics for compost making and the focus on the development of a living soil (Balfour, 1946).
Verhoog et al. (2002) mentioned this approach of organic farming in a negative way as *'the no-chemical approach'*. Behind it is the distinction between living (organic) nature and dead (inorganic) nature. The use of chemicals is associated with 'dead' nature and it is unhealthy. The orientation on this approach is very similar to that in conventional agriculture. This is the reference of the observer, including the way of thinking. Instead of chemical sprays against diseases, farmers use 'natural' sprays or biological controls, synthetic fertiliser has to be replaced by organic manure, and instead of herbicides mechanical weed control is used.
In the growth of the organic sector in the 1990s this approach became more and more important. In 2001, Pollan described the development of the 'Organic-Industrial Complex', which is the rapid industrialisation and commercialisation of organic food production, especially in the USA. Pollan (2001) claimed that the way of thinking behind the industrialisation process is very conventional. The aim is to produce uniform organic products that have to be substantially processed to be able to transport them over long distances. The organic produce can be processed, except for the fact that natural additives are used instead of artificial flavours and substitutes. This leads traders and processors to alter the standards to allow all kinds of 'natural additives'. To the consumer, organic farming is presented as a small, but healthy change. Organic produce is very similar to conventional produce, except for the fact that the (many) ingredients should not be artificial.
Therefore the understanding of naturalness in this approach can be characterised as:

- Replacements of artificial materials by natural materials (as an action)
- Symptom oriented (as the way of thinking)
- Fighting against nature
- Materialistic world view (reductionistic view)

2.2 Naturalness as a holistic systemic concept: agro-ecological laws

As a second step in conversion to organic farming, Bloksma (1991) described the attention for the agro-ecological system. Problems or symptoms are no longer seen in isolation, and the focus is changing towards the context of the problem. Knowledge gathered in the 1960s and 1970s among others by ecologists like Odum focus on the agro-ecosystem as a whole. Scientific thinking is now in terms of relationships, hard systems and energy flows. In agriculture, the farm as an agro-ecological system was formulated as a new level of analysis and as a context of detailed research questions. Instead of the farm's components, the total farming system became the focus of attention (See also Alrøe and Kristensen, 2002).
Verhoog et al. (2002) mentioned this attention for organic farming as *'the agro-ecosystem approach'*. The farmer learns from nature and reflects on processes in nature. In practice this means that the organic farmer wants to model his agricultural practice on nature like an agro-ecosystem. Farmers might experience that during their conversion period they cannot ignore the ecological context of emerging problems. They notice that under organic circumstances it is not sufficient to only stop using chemical pesticides and artificial fertilisers. A new attitude

and another way of acting is needed, based on prevention through knowledge of ecological processes. Diseases are seen as symptoms of an unbalanced system expressed in the lack of balance between plant or animal and farm environment. Rather than fighting pests and diseases with chemicals, the emphasis shifts to control of the environment. A more diverse environment is necessary in which wild plants in hedges, borders or ditches are grown to maintain natural enemies within the farm system. Plant strength can also be increased through the right choice of manure, or by sound crop rotation. All this means that farmers start to think in a more ecological way, looking for the broader context of a problem and realising that the farm should be transformed into a complex, sustainable and balanced agro-ecosystem. Terms such as closed system, mineral cycle, self-regulation and bio-diversity are important keywords to characterise naturalness in this approach of organic agriculture. One needs to work together *with* nature instead of fighting against it. Solutions are based on rational, experiential and experimental ecological knowledge. Therefore the understanding of naturalness in this approach can be characterised as:

- Focus on balancing the agro-ecological system based on preventive management (as an action)
- Context-oriented, based on relationship knowledge in auto-ecology and syn-ecology (as the way of thinking)
- Co-operating with nature
- Systemic world view (as a complex hard system and its inner processes)

2.3 Naturalness as a holistic meeting of the other being: entity or integrity

However, Bloksma (1991) found a third approach to orient on problems in organic farming systems. The attitude is not only based on the knowledge of the agro-ecological context, but also on the inner meaning of the problem or the observed itself and the personal relationship of the farmer to the object. At first, this orientation was recognised in the field of man and animal, when the topic of integrity and entity was introduced. However, recently Lammerts van Buren (2002) introduced a view on the integrity of plants as well, when she discussed the breeding goals in organic farming.

In the discussion on animal welfare a new and additional point of view was introduced which was not covered by measurable health and welfare parameters (Grommers, 1995; Visser and Verhoog, 1999; Verhoog, 2000). For instance, the mutilation of farm animals, the goals of animal breeding were not covered by the existing welfare definitions and additionally the animal was seen as ‘a being on its own’. In organic farming this way of thinking is found in terms as ‘the farm as an organism alike’ and ‘the living soil organism’. This additional element in the welfare discussion was covered by the concept of ‘animal integrity’.

As said, this respect for the animal’s integrity first emerged in animal husbandry and was transformed into the concept of ‘the animal’s needs’ (Rist, 1987; Bartussek, 1991). Cattle should be fed as ruminants instead of monogastrics (Bakels and Postler, 1986; Haiger, 1989; Spengler, 1997). They should be kept as horned animals in a well-balanced herd. De-horning can only be avoided if the farmers are prepared to develop a new way of herd management, housing and feeding based on the cow’s needs (Baars and Brands, 2000; Waiblinger *et al.*, 2000). Also the cows’ right for outdoor grazing is derived from respect for the cow’s ‘nature’. Outdoor grazing can not be replaced by an outdoor run only. This approach manifests itself among others as respect for the integrity of life, for the agro-ecosystem, and for human needs (including social and economic integrity). The term ‘natural’ here refers to taking into account the *characteristic nature* of plants, animals, man and ecosystem because nature has an intrinsic value. Respect for the integrity of the farm ecological system, the living soil, the

plant and animal species used is the result of an inner process of involvement with the way of being of natural entities. Farmers begin to experience that their focus on problems and solutions is connected with their personal attitude and their personal relationship with either the soil or the cultivated plants or animals. They experience that organic farming is more than a complex ecological mechanism and more than the sum of the parts. This feeling is also present in relation to the plants or animals they take care of. They develop a respect for the wholeness, harmony or identity of a living entity based on a personal involvement with the life of plants or animals.
Verhoog et al. (2002) mentioned this approach of organic farming *'the integrity approach'*. The recognition of integrity reflects an attitude of respect that inspires the farmer to find the right course of action at the right moment in the specific farm context. Therefore the understanding of naturalness in this approach can be characterised as:

- Action is based on the respect for the identity of the observed itself (soil, plant, animal and the farming system) (as an attitude before action)
- Entity-oriented, based on a personal identification of the farmer (as the way of thinking)
- Working together based on an inner understanding of the other's nature
- Holistic world view, based on the connection with the observed.

These three approaches are a very helpful tool to distinguish in several discussions of organic farming, for instance 'how to think about GMO's in organic farming' (Baars, 2002) or 'what is the identity of the economical process in relation to regionality and Fair Trade'.

2.4. Naturalness in relation to aspects and choices in organic breeding

In Table 1 the application of the general scope on naturalness is made for animal breeding. In the first column the general focus explained above is repeated. Column 2 explains the characteristics of each approach in terms of a view on breeding, whereas the third column has been used for examples of the specific focus.

Table 1. Elements of naturalness adapted for approaches within organic animal breeding

Approach of naturalness	***Essential conditions, points of departure and attitude);***	***This will lead to …* (Practical examples)**
No chemical approach: With regard to animal breeding the main focus is the genome. Life is only physical and the animal is only a production factor for the system. Thinking about the world in terms of parts which can be constructed	1. Breeding is the genetic improvement of animals (by crossbreeding and selection) focused on DNA to have an efficient use of substances (The animal is equal to its DNA; the animal as a produce). The environment is seen as the second, the follower, which will be standardised world wide. 2.With the help of quantitative calculations the best animals will be selected out of a world population. Breeds are not important. 3. Breeding knowledge is based on quantitative genetics.	1. Efficient and high productive sires and dams without embryotransfer in their pedigree; In vitro fertilisation and ovum pick up are not allowed 2. Hybrid crosses for all species 3. No GMO, because of the use of artificial materials 4. Artificial Insemination is allowed for pragmatic reasons. 5. Interventions at a chemical level in the fertility cycle are not allowed (f.i. hormones, ET).
Agro-ecological approach: The context of the genome (= the animal as an	1. Breeding is based on the knowledge of animal ecology and physiology and oriented on balancing of functions related to secondary production characteristics: - type of animal (built, shape, longevity),	1. Linebreeding and threecross rotations based on longevity 2. Index for longevity or sustainability in a conventional breeding program (OGZ)

individual being) and the context of the animal (= the herd and the farming system) are the central focus: **- ecological coherence** **- thinking in processes** **- support of self-regulation** **- system oriented**	- animal and environment. 2. Breeding is focused on the selection of animals that fit in a regional, land related farming situation. 3. As a result of breeding the individual animal should be in balance. 4. Breeding is based on quantitative animal models, which include additional values for an efficient animal production.	3. Harmony of built and shape: for instance Weeks' Triple aAa-system; Selinger and Dekker: the golden section as a harmony imagination. 4. Refusal of GMO, because of side effects for the animal itself (health, welfare) and the environment 5. Searching for suitable, regional breeds for specific styles of organic farming (importance of genotype x environment interaction)
Integrity approach: **The animal's integrity is the main focus:** **- life has its own specific dimensions;** **- respecting the integrity (entity)** **- explicit role of the human being** **- man and nature create something additional** **- oriented on the identity**	1. Breeding is the eliciting of animal characteristics with the respect for and the insight into the species, the breed and the individual animal: - insight in the animal type - insight in the role of the animal into the system as a whole. Through this focus the specific value on its own of each breed will be strengthened in a specific cultural environment. 2. Breeding is based on the personal insights of the breeder about the animal needs and the environment he provides them, and the adaptation to the farm circumstances. 3. Genes are seen as the inner preconditions for the development of organisms; not the genes are creating features, but the animal species do so according to the inner preconditions of the genes and the outer preconditions of the environment. Cytoplasmatic hereditary has to be taken in account. 4. The limits of breeding and the breeding goals are affected by the consciousness of the animal's integrity. 5. Optimising environment for an animal species is a way of breeding: it opens the possibility for the animal species to show it's whole integrity in the single organism.	1. Dutch Frisian breeders: kin breeding and on-farm development of lines. 2. Specific meaning of the species within the mammal kingdom (Schad) in relation to its specific characteristics (Spengler) 3. Ideal imagination of the cow: f.i. the cow with a highly specialised digestion- and metabolic system to transform roughage and highly differentiated limbs: a walking animal and sex dimorphism (Bakels) 4. A personal and inner imagination of the animal: Endendijk's imagination of the ideal cow. 5. Refusal of GMO because the natural mating is taken from the animal; the technique is forcing the matter and crosses natural boarders of species. 6. The natural way of mating cannot be taken from the animal.

3. The elements of bio-dynamic animal breeding

Ideas about bio-dynamic breeding have been explicitly formulated by Spengler (1997) and can be derived from Baars and Nauta (2001; 2002). As a more general statement about organic animal breeding, Baars and Nauta (2001; 2002) formulated that breeding in organic farming should enlarge the race diversity, focus on the herd adaptation and respect the harmony of the animal build. Spengler (1997) stresses the relationship of the genome in relation to the (spiritual) being and the role of the environment.

Below these elements are further explained taking into account that these aspects can be recognised as different views on naturalness (compare Table 1).

3.1. The role of the genome in relation to the environment (Spengler, 1997)

Spengler introduced two important elements of the bio-dynamic breeding view as an expression of the integrity approach:

(1) Not the genes are creating the organisms nor they are the features of the organisms. However, there is a principal entity ruling the whole organism including its genes; like any principal this is not a material thing, but a spiritual or mental activity. It can be seen as the "intrinsic mental activity of the animal species" (Rist et al., (1996) and (Rist et al. (2000)) or "morphogenetic fields" (Sheldrake, 1983) or "the mind of the group (species)" (Steiner, 1912, (1923)) or the "typus" as the principal organism (Goethe (1795); Steiner (1886)). The genes are seen as the inner physical preconditions for the species to develop the organisms (compare the piano in relation to the composer and his score).

(2) The preconditions of the environment are important for the development of organisms as well (genotype x environment-interactions!): the more they fit to the species-specific characteristics the better the species can show its intrinsic features in the single organism (compare 3.4). To characterise these species-specific characteristics, Spengler used the investigations of Schad (1971): f.i. the cow as an ungulate with highly specialised limbs and as a ruminant with a very highly specialised digestion- and metabolic system. The preconditions of the environment are to a great extend influenced by humans. Referring to Steiner's "Agricultural course" (Steiner, 1924) it is even thought that the environmental conditions are taken up in the heredity of the breed. (Actually this kind of thinking is connected to Lysenko breeding and part of the nature-nurture discussion.) Spengler mentioned the word 'preconditional breeding', which doesn't mean that just the preconditions are breeding the animals, but that they play a great role for what kinds of breeds the species themselves can create. The preconditions of the environment and the preconditins of the genes as well are seen as the "boundaries" for the species creating individual organisms. That's why in such a breeding the herdsman should be 'in conversation with his animals to elicit the proper phenotype'.

3.2. Genetic diversity by site adapted landraces (Baars and Nauta, 2001, 2002)

As an expression of the agro-ecological approach, bio-dynamic breeding should be used to reinforce the relationship between the animal breed and the environment in which it has to live. Plants and animals express themselves differently in different environments. Differences between farms spring from differences in soil quality, their situation in climatic zones, etc. (compare Spengler's 'preconditional breeding'). Therefore, out of this view breeding and improvement should follow on from the improvement of the original native breeds. That is to say, one aims for small-scale improvements that consciously seek to reinforce those qualities that suit a particular environment. It is not so much a question of adapting as of fitting in. The family breeding method as currently practised by a handful of individual breeders ensures that a farm-specific cow will emerge within a current farm environment (Baars, 1990). Family breeding offers ideal opportunities to achieve versatility. Regionally oriented breeding of this nature makes it possible to reflect the diversity present in the different landscapes in physiology and behaviour of a domesticated animal such as the old landraces. Animals and surroundings can thus be brought into balance and be further improved together.

3.3. A sense of beauty and proportion: harmony in build (Baars and Nauta, 2001; 2002)
As an expression of the agro-ecological approach, some breeders also consciously take account of the 'harmonious proportions' of the animal in addition to biased production characteristics. An animal's build and bone structure are considered important determinants of whether an animal will be a good milking cow. The American Bill Weeks developed the 'aAa' (triple A) system, in which he supplements production-based criteria with the strong and weak points of an animal's build. In pairing a dam and a sire he tries to select animals in such a way that their offspring will be a more harmoniously built dairy cow. Weeks posed that the better a farm succeeded in 'harmonious' pairings, the longer the mean life expectancy of the herd, in comparison with farms that did not practice compensation pairing. The ideal cow averages out all the extreme types in its build and stands at the centre of a circle (Figure 1). The extreme types make up the circumference of the circle.

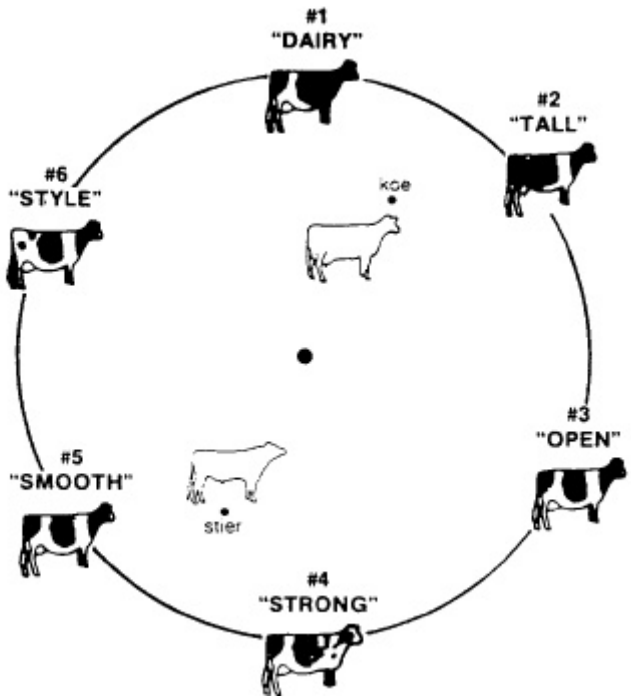

Figure 1. Sketch of an aAa pairing: extreme builds of animals are categorised in six main types. Each cow receives a visual score for the three strong and the three weak points in her build. In the mating the weak points in build are compensated by the selection of a bull with as many compensating characteristics as possible.

Another view of the harmony concept can be traced back to Dutch Friesian breeder, Dirk Endendijk (Baars, 1990). As a breeder he values a harmoniously built cow. Harmony in build makes a milk cow into a good breeding cow. Endendijk judges this by eye from his own sense of harmonious proportions. Such a personal relationship can be seen as an expression of the integrity approach. Parallel, in the 1970s, the Dutch Friesian breeder Cees Dekker defined 'the ideal Dutch Friesian cow'. Dekker goes so far as to indicate the ideal cow in numerical proportions of all body elements. What is striking about Dekker's definition is that it

essentially comes down to the numeric ratios of 1:2 and sometimes 1:3 [1]. The type of focus on ratios by Dekker shows much similarity to the ratio in the Divine Proportion [2] that was used in the design of paintings and buildings and that led to a harmonious composition. It should be noted that Endendijk, Dekker and Weeks are all concerned with the relationships between body measurements, and not with the absolute value of the different variables. This concern is a typical expression of an agro-ecological approach at the level of the individual animal. Consciously or unconsciously, all three breeders have an instinctive sense of beauty that is normally only discussed within arts instead of science.
Another way of incorporating a feeling for interrelationships and proportions is to consciously consider the effect that, say, breeding for milk production may have on the rest of the animal. Genetic progress (in terms of milk production) appears to proceed fastest when breeding goals focus on only one or a few characteristics. However, in that case one must also consider the characteristics that are changed unintentionally and simultaneously. Conventional breeders as Endendijk, Dekker and Weeks looked at the interrelationships between the different characteristics. In this way they can prevent breeding focusing too singularly for a specific characteristic such as height or INET [3] (Hansen *et al.*, 1999). The danger in reducing breeding to milk yield is that the context in which the data were collected can no longer be assessed. Increased milk yield may lead to fertility problems (Ostergaard *et al.*, 1990) and reduced efficiency of fodder utilisation (Yerex *et al.*, 1988), mainly because of reduced attention to cow height and cow weight. For this reason it is essential to test data continuously in real life, looking at the animal as a whole (Endendijk, 2000). This also prevents certain characteristics, such as fertility and life expectancy, to be forgotten or overlooked. Again, this is an expression out of an agro-ecological approach at the level of the individual cow.

3.4. Action-based on animal's integrity: animal-specific criteria (Baars and Nauta, 2001, 2002)
Another alternative to prevent reducing the cow to its component parts was formulated by Professor F. Bakels (Haiger *et al.*, 1988; Haiger, 1989; Postler, 1990). As a geneticist and veterinarian, Bakels developed a breeding programme that centers on 'lifetime production', which can be seen as an agro-ecological criterion. Bakels' basic premise is to carry out selection based on characteristics that include all the sub-aspects of the cow (this method can also be applied to pigs and poultry). Here we are concerned with finding criteria which are not inspired by economic considerations (for example protein and fat content and now lactoglobulin content) but which are taken from the totality of the cow as a living organism. Bakels formulated the agro-ecological balance of the individual animal in a positive way, when he introduced the primary selection characteristic as *vitality (or fitness)*, the capacity of an animal to remain productive throughout its life without any serious problems. This is translated into life expectancy and energy production during life (in offspring and/or milk and meat) (Zeddies, 1972; Essl, 1989; Postler, 1990).

To assess Bakels' viewpoint properly, it is important to understand that he attaches value to, among other things, the process of domestication of the cow and the regular behavioural patterns which the animal itself displays in this process. In this sense, Bakels, unlike Weeks,

[1] Dekker developed standard measures for the Dutch Friesian defined on an age of 4-5 years. In total he used 33 points for his score of an ideal body build (see Baars, 1993). As an example the proportions from the udder: the udder length should be 45 cm; udder depth measured from the belly 22.5 cm; distance between the teets 11.5 cm and teet length 5.5-6 cm.
[2] The divine proportion or golden section ratio is 1:1.6180 (Huntley, 1970)
[3] The Dutch calculation of improved milk yield through breeding expressed as additional income.

Endendijk and Dekker, has an additional consideration for the intrinsic characteristics of the cow as a criterion of integrity. He allows the animal itself, as it were, to indicate the limits which should be observed in breeding in order to evaluate the cow as a cow. Bakels shows in his 'nature-like breeding method' how the domestication process has proceeded from prehistoric cattle to our domesticated cow. From this domestication process he traces all kinds of functional characteristics which are now a proper part of the cow. The following characteristics should be considered in the breeding process of dairy cows (Postler, 1990; 1991):

- sexual dimorphism: bulls should be male-like in their expression and body figures and kept for meat production, whereas cows should be feminine and kept for milk production
- cows are long distance walkers
- cows are ruminants (compare Schad, 1971 and Spengler, 1997)
- cows have a functional build (pelvic shape, flexible back)
- physiological traits which are sex-linked.

With this system Bakels developed practical and practicable breeding and selection characteristics which leave the domesticated animal as 'whole' as possible, and which are in keeping with the 'nature' and behavioural preferences of the animal (Haiger *et al.*, 1988; Haiger, 1991).

Schad (1971) focuses on animal breeding out of an integrity approach, when he chooses another entry point to identify the typical characteristics of the 'cow being'. Based on the morphology and build of the animal species, its behavioural traits, and vital functions Schad classifies mammals into three main groups: rodents, predators and ungulates (compare Spengler in 3.1). Schad states that this trinity is a reflection of the threefold structure of man's spirit: thinking, feeling and willing (see also Table 2.1). Baars E. and Nierop (in prep.) prepared a statistical analysis of these morphological principles. They showed, that the basics of these three main mammal groups were found in e.g. morphology, growth rate, teeth and birth. All the different types of animals show a certain bias. By becoming aware of these biases, we can ask ourselves what function each animal will serve for nature, agriculture and man. According to these correlations, Schad's work illustrated that a cow, for instance, is in the first instance the perfect example of a roughage converter because of her special anatomy and physiology. The animal metabolises and transforms plant substances into milk, meat and manure, heat, work etc.

Such an elaboration makes one aware of the typical characteristics of, say, cows. Just as Bakels' approach, Schad's can clarify what kind of being we are dealing with. Human action could now be aimed at housing and feeding all domesticated animals in accordance with their nature. Breeding and selection must allow the essential characteristics of each domesticated animal to come into their own. Bartussek (1991) indicated gradations of 'naturalness' in the agricultural production system. For this purpose he designed an 'animal need index' for feeding, welfare and breeding. Criteria for the index are drawn from animal-specific needs and can be seen as an expression of the integrity approach. Rist (1987) also started from the level of animal-specific needs with regard to animal welfare and housing. Rist pointed out that the psyche and its expressions, both in terms of well being and suffering, are examples of immanent forces. Herein lies the problem with the positivistic scientist, whose numerically based approach overlooks this immaterial level (see also Rist et al., 2000).

3.5. Three-foldness as a breeding system?(Baars and Nauta, 2001, 2002)

It is striking how often breeding systems are based on 3 lines or families. In pig breeding, for example, often a three-way cross is used of three inbred non-related lines with complementary practical characteristics. The offspring of this cross are the most highly-productive animals in practice. Bakels too opted for three lines when choosing his parent material. Further study of these lines (Haiger *et al.*, 1988) makes it clear that they complement each other on many points (early maturing, late maturing, conformation, long-leggedness, milk production, fat and protein contents). Dirk Endendijk also uses three main lines on his farm, (Kate, Sjoukje and Jantje) plus a few other complementary families. In Weeks' aAa system we also see a division of the two main types into three subtypes. Qualities can be found in these subtypes which can in part be traced back to the three-part system developed by Schad (1971).

It may be that this three-part system is not a coincidence but the elaboration of a natural law, connected to the three qualities of man, as elaborated previously by Schad. It is clear from the above examples that a more balanced, more harmonious entity is created by bringing together and harmonising three different qualities. By consciously striving to harmonise these different qualities for every animal species or breed, a more balanced animal will result. Breeders could become more aware of the different qualities and biases in individual animals. Good, balanced, practical animals occur when the types are brought together by pairing. Bakels, for example, advises farmers to apply rotational crossbreeding in which lines A, B and C continually succeed each other. Further research and further elaboration of this idea with a group of cattle experts would be worthwhile. In so doing it will be important to properly explore the three qualities and assess them on their own merits.

4. The practice of biodynamic breeding

4.1. Biodynamic Cattle Breeding in Switzerland

In Switzerland there are around 200 biodynamic (Demeter-) farms. Around 110 of them are keeping dairy cattle. The Swiss "Braunvieh" and the "Simmental x RH" are the most frequent races on biodynamic farms. Some breeders are practicing kin breeding with the "Original Braunvieh (OB)"-race or with the "Simmental"-race. There is no dehorning of animals on biodynamic farms. The average milk yield over all biodynamic farms in Switzerland amounts to about 5'500 – 6'000 l per cow and year.

Around 40 biodynamic farmers are specially interested in dairy cattle breeding. Most of them are keeping their own sires and their family breeding is based on their personal insights about the animal needs and the enviroment they provide them ("preconditional breeding"). All of them are passive or active members of the swiss "work group for biodynamic cattle breeding": around 15 biodynamic breeders are meeting 2 or 3 times a year on one of their farms to discuss special breeding-questions, -problems or -ideas arising on this farm and to improve their understanding of the animal. The human-animal-relationship, the use of technical aid and installations in the barn and in the milking parlour and the dimensions and structures of loose housing systems are important subjects disussed in this work group. The exchange of animals among biodynamic breeders is organised by a monthly published list of animals for sale and of wanted animals.

4.2. Biodynamic Cattle Breeding in The Netherlands

In 2000 an inquiry was made on breeding purposes of organic farms (Elbers and Nauta, 2000). Actual farm figures of the year 2000 were related to the year of conversion and the blood group of the farmer (EKO versus biodynamic). There was a response of 155 farms,

only 17% out of these were biodynamic farmers. Some general tendencies are found within the total group of organic (EKO + biodynamic) dairy farmers, shown in the left side of the table. There is a steady increase of milk yield per cow. The percentage of dairy type within the herds increased, whereas the use of 'new' dual purpose breeds decreased. At the same time the use of artificial insemination for mature animals increased till 90% of the fertilisations, whereas young stock was artificially fertilised for 84%. The percentage of on-farm bulls used for natural mating decreased until only 30%.
At the right side of the table some typical characteristics of the biodynamic farms are shown: in comparison to the EKO farms, biodynamic dairy farmers produced less milk per cow (- 1112 kg), had smaller farms in terms of milk quota (- 104,000 kg) based on less cows per farm (12.0 cows). The type of cow at the biodynamic farms was less based on pure bred dairy type (- 19%), whereas more breeds of a 'new' dual purpose origin were used (+ 24%). Biodynamic farmers used less artificial insemination, both on mature animals (- 18%) and young stock (- 30%) and the number of fertilisation by natural bulls were higher (+ 29%). Biodynamic farms were much older, the year of conversion was much earlier (- 9 years) than the EKO farms and there was hardly any conversion to biodynamics after 1997. Although these results are interconnected (being older and being biodynamic), it shows that biodynamic farms do have a different approach on animal breeding, which fit with the overall description shown in this paper.

Year of conversion **Characteristic**	**<91**	**91-96**	**97-98**	**99-00**	**All**	**EKO**	**BD**	**P-value**
FPCM/cow/year (kg)	6738	7098	7189	7978	7281	7468	6356	<0.001
Q/farm (tonne)	2.75	3.49	3.47	3.38	3.30	3.48	2.40	0.002
Milking cows (N)	43.8	52.7	51.4	48.7	49.3	51.3	39.3	0.026
% dairy type[1]	66	69	70	73	70	73	54	0.011
% 'new' dual purpose[2]	27	15	13	8	15	11	35	0.002
% AI with milking cows[3]	72	77	89	90	84	87	69	0.032
% AI with young stock[3]	43	57	79	84	69	74	45	0.004
% on-farm bulls[4]	67	56	29	30	42	37	65	0.009
Year of conversion	1985	1994	1998	1999	1995	1996	1987	
Number of farms (N)	33	26	56	40	155	129	26	
% biodynamic farms	61	19	0	3	17			

[1.] dairy type is based on the following breeds: Holstein, Red Holstein, Yersey; all other types are defined as dual purpose: Dutch Frisian, Meuse Rhine Issel, Brown Swiss, Montbeliard, Blaarkop and some other smaller breeds. It is an exact estimation of the ratio in the herd.
[2.] 'new' dual purpose is defined as the presence of more than 20% of blood as dual purpose other than the (old, original) Dutch Frisian type.
[3]. based on an exact estimation of the farmer per cow in percentages.
[4.] based on the positive answer, if there was a bull present used for mating, either mature animals or young stock.

5. Conclusions

In this paper some specific aspects on bio-dynamic animal breeding were presented and it became clear that in terms of naturalness, bio-dynamic breeding has its main entry point at the level of integrity. Bio-dynamic breeding adds some specific thoughts and attitudes compared to organic breeding in general. These additional elements are related to the spiritual view on life and living. This attitude is transformed in some specific preferential actions in breeding,

like natural mating. However, such actions cannot be only attributed to bio-dynamics, although such practice fits very well in the bio-dynamic ideas (for instance 'family breeding'). Out of the right gut feeling of practitioners and several scientists and without the specific anthroposophical backgrounds very similar values in breeding were found (for instance Bakels' view on the cow as a being or Dekker's inner feeling for harmonious cows). Additional points of view in bio-dynamic breeding which are a contrast to the conventional breeding views are: the role of the genome in relation to the environment on the one hand and the being in relation to the intrinsic mental activity of the species on the other hand.

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