Researching sustainable agriculture
The role of values in systemic science[1]

Hugo Fjelsted Alrøe[2]

ABSTRACT: This paper presents a specific perspective on the science demarcation issue, the perspective of systemic science. A systemic science is a science that influences its own subject area. Agricultural science is an example of such a science - a point that is particularly evident in connection with research in organic farming, which forms the practical context of this paper. Far from the ideal of being 'value-free' and objective, the systemic science must, upon recognising itself as systemic, acknowledge the role of values in research and include value inquiry as a specific research task. But still, the systemic science insists that it *is* science. Given that it is science, what then demarcates 'science' as different from other social activities? Or, in other terms, what are the proper criteria of scientific quality for systemic sciences? The paper aims to develop the conception of systemic science and investigate some basic aspects of science as a learning process, in order to work towards a more adequate foundation for developing and evaluating systemic research methods, and for determining appropriate criteria of scientific quality in systemic science.

KEYWORDS: agriculture, demarcation, objectivity, organic farming, quality, reflexive, research, science, systemic, values.

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[2] Danish Research Centre for Organic farming, Research Centre Foulum, P.O.Box 50, 8830 Tjele, Denmark.
Email: *hugo.alroe AT agrsci.dk*

1. Introduction

Answering the question of the demarcation of science from non-science, or the question of what characterises science as science, is presumably highly dependent on what areas of science (or 'aspiring to be science') are involved as the practical context for the answer. The present paper has a practical background in agricultural science and, in particular, agricultural systems research and research in organic farming. Agriculture is characterised by an agricultural practice that involves both social and natural systems, and research in agricultural systems therefore faces the dual challenge of understanding complex agro-ecosystem interactions and handling the involvement of human actors, their practices and preferences. Agricultural systems research is inherently framed in a social context, and involves questions concerning different interests and values in society as well as different structures of rationality and meaning (Kristensen and Halberg, 1997). Organic agriculture, in particular, has developed as part of a wider organic movement incorporating producers, manufacturers and consumers. The organic movement differentiated itself from conventional agriculture by way of formulating a common foundation of principles and goals, which was based on a perception of humans and human society as an integrated part of nature and connected to an alternative agricultural practice (Woodward *et al.*, 1996). Today, organic agriculture is based on explicit rules as well as broader formulated principles and goals for farming and manufacturing (see figure 1).

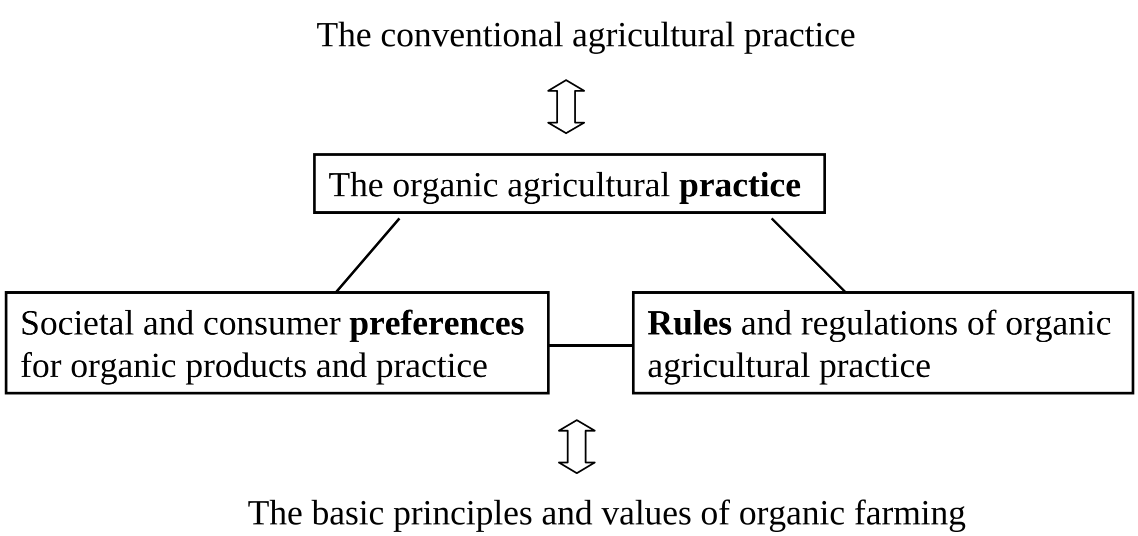

Figure 1: Three elements in the development of organic agriculture: practice, preferences, and rules – all related to the basic values as well as to the conventional practice (Alrøe and Kristensen, 2000a).

2. Systemic science

The agricultural background brings a specific perspective to the issue of demarcation, because agricultural science is what we can call a 'systemic' science. A systemic science is a science that influences its own subject area. Agriculture is an area in rapid development - both in terms of technological development and in terms of the development of new production systems in response to problematic impacts of agriculture on the environment, human health, nature quality, and animal welfare. And agricultural research plays an influential role in these developments. Hence, agricultural science influences its own subject area, agriculture, in important ways.

Science, taken as a whole, is clearly systemic. And there are many other specific systemic sciences, besides agricultural science, such as health, environmental, and engineering science (including, notably, computer science), and economic, sociological, and political science, as well as the humanistic sciences. And even some of the biological sciences (notably, the biotechnological sciences) and physical sciences (e.g. materials and chemical sciences) are also influencing their own subject areas. Sciences that are not systemic in this sense are for instance the strictly historical sciences, whether in human or natural history. We might call these non-systemic sciences 'objective' sciences (maintaining the quotes as a reminder that 'objective' refers only to a regulative ideal and not to the epistemic independence of knowledge). The ‘objective’ science must have a purely historical or ‘spectator’ attitude towards its subject area – all applied sciences are systemic sciences.[3] Even the 'objective' sciences are, however, involved in the reflexive learning process of social systems (and individuals), playing a creative role in the forming of identity and self-understanding. And this constructive social learning process, involving the ‘objective’ sciences as cognitive tools, is clearly systemic.

When science plays a part in the world that it studies, the criteria of objectivity becomes problematic as a general scientific ideal[4] - even more problematic than in the face of science as a social system that is

[3] We might have used the term ‘applied’ instead of ‘systemic’, were it not for the misguiding connotations of ‘applied’ with respect to the image of science I am advocating here. Contrary to the humble application of the results of pure science, systemic science involves the deliberate use of special ‘objective’ sciences as tools for adressing problematic situations in a complex (not reduced) reality.

[4] See also Karl Popper (1957:chapter 6 and 32) who recognises that social science cannot be objective due to the influence of social science on society - and that this interaction between the observed object and the observing subject is not limited to social science, but also found in biology, psychology, and, even, physics.

similar to other social systems. Recognising science as a social system does not in itself remove objectivity and truth as general regulative ideals. But recognising science as systemic does delimit objectivity to a specific criterion concerning well-specified research activities, and it does destroy the ideal of general truth to the favour of contextual truth. A systemic science cannot avoid influencing its own subject area in the course of learning about it, and therefore the intentional aspects of the learning process become of key importance. But this only becomes obvious to a *reflexive* systemic science, which can recognise its own systemic character. Far from the ideal of being 'value-free' and objective, the reflexive systemic science acknowledges the role of values in research and includes value inquiry as a specific research task. But still, despite this admission of values, the systemic science insists that it *is* science. Presuming this is so, what then demarcates (systemic) science from other social activities? And what exactly is the role of values in systemic science?

3. Science as a learning process

Prior to the question of whether agricultural systems research and similar systemic areas of science can truly be called science, lies the question of the determination of what science is, including the question of demarcation as the defining distinction between science and non-science. On the other hand we better be prepared that there might not be a criterion of demarcation, or that there are a range of criteria, which together determine science as science, and gives directions on what good science is. I suggest that an answer to the question of what science is, is best sought by analysing science as a learning process as opposed to a system of knowledge or a productive activity (even though science also incorporates these aspects). Seeing science as a learning process provides a different perspective on ‘demarcation’.

The positivistic distinction between science and 'metaphysics' used 'verifiability', or the like, as a criterion of meaning that indicated scientific knowledge as meaningful and sensible as opposed to non-sensible metaphysics. Karl R. Popper claimed that his criterion of refutability, falsifiability, or testability, was not a criterion of meaning but a criterion of demarcation between science and non-science, and that metaphysics could be sensible knowledge (e.g. Popper, 1998:257-58). Still, Popper's focus in on knowledge (the theory or the theoretical system) and not on learning or method - the method of science is presupposed and demarcation is the question of which hypotheses or theories can be subjected to the method of science. In recent sociology of science the method of science has been put under scrutiny, and the similarities with other social activities have been disclosed. But the philosophical question of what might demarcate scientific learning is still open.

In a learning perspective[5], science shares common features with other learning processes, but it also has some distinct features. Common features are found when considering science as a cognitive system and scientific learning as, in some respects, similar to the learning of organisms. This is a naturalistic approach to science in line with John Dewey's theory of inquiry (e.g. Dewey, 1991:30ff). The naturalistic approach does not imply that there is no difference between less complex and more complex kinds of cognition - only that there are common features and that something can be gained from investigating these features. Some of the differences between the learning process of science and that of an organism are entailed in the ingenuity of scientific research methods. Other differences can be found by looking at science as a social system.

Considering science as a social system, one of the distinct features of scientific learning is the *public* nature of scientific communication, as emphasised by Karl Popper, and the critical approach of science, which is connected to a fallibilistic view of scientific knowledge, as found in the tradition of philosophical pragmatism (Charles S. Peirce) and in the dominating philosophy of science of the 20th century (e.g. Albert Einstein, Popper). Niklas Luhmann (e.g. 1989:76ff) describes science as a social communicational system - science is one of the functional systems differentiated in modern society, and it is differentiated through a specific code of communication based on the difference between true and false. Luhmann states that: "The code of scientific truth and falsity is directed specifically toward a communicative processing of experience, i.e. of selections that are not attributed to the communicators themselves[, and] … towards the *acquisition* of new scientific knowledge." (Luhmann, 1989:77-78). In this communicational perspective science can be seen as a key learning process in society – with due consideration of the variety of groups, interests and values in society.

[5] The learning perspective is treated in more detail in another paper: "Science as systems learning" - please email me for a preprint.

In order to investigate science as a learning process, it might be useful to consider the elements of science as a social system in more detail. Looking at, for instance, agricultural science, there are at least four levels of systems[6] involved, which can be designated as the researcher, the research group, the scientific community, and the society (figure 2).

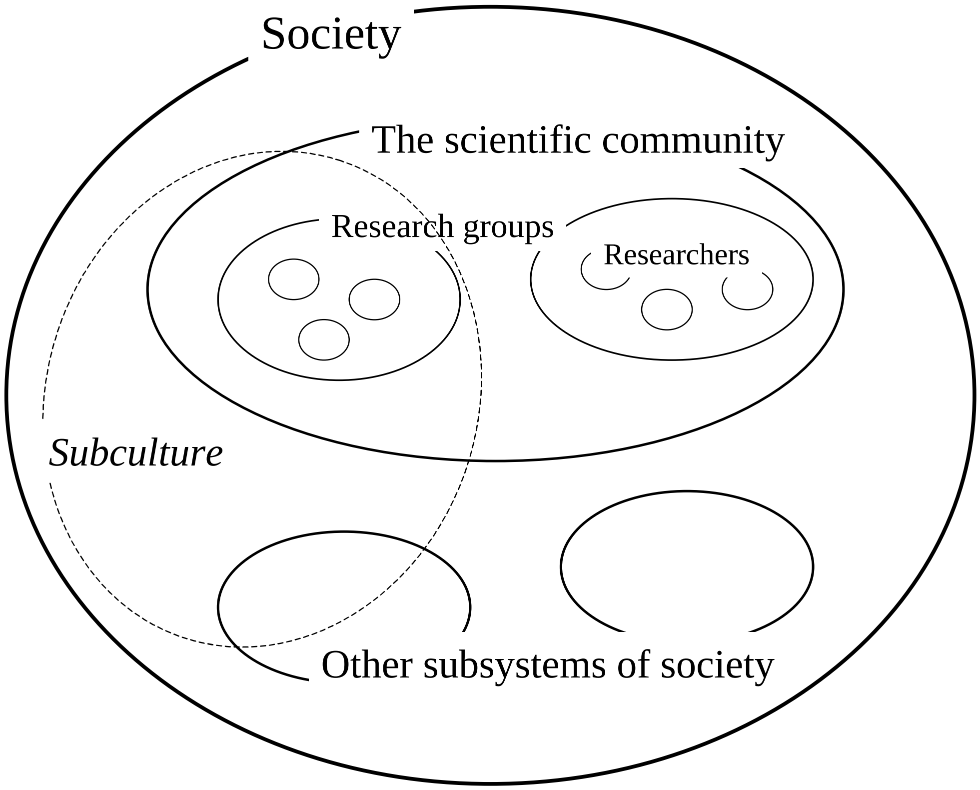

Figure 2: Four levels of science as a social system. Each level involves a differentiation of subsystems by way of a particular difference between system and environment. The key learning aspects at each level are the following: society - discourse; scientific community - peer criticism; research group - apprenticeship; researcher - experience. Also indicated is a 'subculture' of society, such as for example the ecological farming movement, which makes a distinction across the levels of science.

[6] In accordance with Luhmann (1995:16ff), the difference between system and environment is taken as the systems theoretical point of departure, and levels of systems are understood not as structures of wholes and parts, but as structures of systems differentiation by way of further system/environment differences within the system. It is, however, difficult to depict this view in a figure. Furthermore there is a problem with fitting the individual researcher into a figure of social systems.

The different levels involve different aspects of scientific learning and the production and reproduction of different kinds of knowledge as elements of the system. The following is a tentative description of these levels. The level of the *researcher* involves learning by experience and intuition, and the development and reproduction of inherent, experiential knowledge, bodily skills, etc., by way of personal study and practice. The level of the *research group* involves the learning of scientific methods, such as the ability to observe (e.g. the identification of plants or the diagnosis of diseases) and to make experiments, by way of some form of apprenticeship. The research group distinguishes itself from the scientific environment by way of communal skills, common research goals, and collegial loyalty. The level of the *scientific community* involves the learning of 'truths' - scientific or warranted knowledge - by way of peer communication and criticism. The scientific community distinguishes itself from the social environment by impartiality and objectivity. The level of the *society* involves the learning of 'good' or relevant knowledge by way of discourse on the values, goals, and visions of society. Also shown in figure 2 is a 'subculture' of society, which distinguishes itself from its environment in terms of metaphysics (or worldview), rationale, and values. An example of such a subculture is the ecological farming movement.

In terms of learning ‘model’, considering science as a cognitive system is most appropriate at the level of the researcher and the research group, while the perspective on science as a communicational system is more appropriate at the level of the scientific community and society. Thinking of science as the learning process of society, we can distinguish between communications that are internal and external to the scientific system – peer criticism, for instance, is internal to science. According to the quote (see above) from Luhmann, the (internal) scientific communication is based on “selections [of experience] that are not attributed to the communicators themselves” – in other words it is based on ‘objective experience’. In the next section I shall look at the relationship between the systemic ‘involved’ research and the ‘objective experience’ of scientific communication, and the question of how experience is ‘objectified’.

4. The self-reflective circle of systemic research

Looking at science as a cognitive system, we can picture the learning process of (reflexive)[7] systemic research as a self-reflective circle – a cyclic cognitive process including the representation of oneself as another (figure 3). This is in analogy with human self-conscious reflective learning based on the ability to take a mental step out and look upon oneself from outside – and use this outside view in later action. Self-reflection starts from the viewpoint of the 'actor' – the first order phenomenological viewpoint of a cognitive system (with the capacity for self-reflection) – then it moves to a second order viewpoint, where the 'observer' views the system from outside[8]. And the observations made from this outside point of view can take effect upon returning to the first order viewpoint of the system. From the viewpoint of the 'observer', both the system and its 'actor'-Umwelt[9] is seen as part of the observer's Umwelt - the observer looks at himself as another. In this observer perspective it is possible to make a distinction between the *Umwelt* of the system, corresponding to the actors phenomenological world, and the *environment* of the system (in Luhmann's sense), which is the distinction between system and environment from the stance of an objective observer. In this way the phenomenological world of the cognitive system can be expanded through self-reflection.

When doing systemic research – researching sustainable agriculture, for example – systemic science involves joggling these different points of view. The learning process of a reflexive systemic science involves moving from a specific point of departure, the inside point of view, to a reflective, outside point of view and back, to take action in the system. Sometimes the researchers are, in a sense, already within the system,[10] and the worldview, rationale and values are sufficiently evident to initiate the research. But often there is a need for a determination and clarification of the inside point of view. The inside view can be approached by way of interviews with farmers and consumers, participatory

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[7] Sciences that are systemic without recognising their own systemic nature obviously cannot engage in this kind of learning process.

[8] Including observations of the cognitive system's first order observations – hence, 'second order'.

[9] 'Umwelt' is used as a term for the phenomenological world of a cognitive system in line with Jakob von Uexküll (e.g. 1982), see further in "Science as systems learning".

[10] The existence of 'subcultures' in society rises the question of how research relates to the subculture, both in a more philosophical sense and in terms of *organisation*. An example illustrating the latter difference can be found in the organisation of research in organic agriculture: In some countries (such as Switzerland and Germany) organic research is primarily found in separate research institutions closely connected to the organic 'subculture', while the organic research in other countries (such as Denmark) is carried out by researchers on 'conventional' research institutions. This is of obvious

research including public meetings, etc., which can provide some access to the values and rationales involved in the dynamics of this particular socio-ecological system.

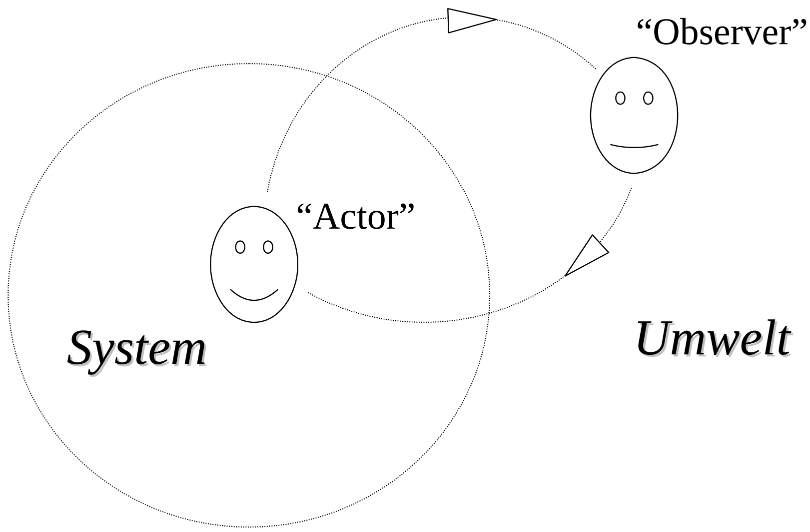

Figure 3: The self-reflective circle of learning in systemic research, moving from an inside 'actor' viewpoint to an outside 'observer' viewpoint, and back.

Taking an outside position – the objective, distancing stance entailed in the conventional criterion of objectivity – is the hallmark of science and also an indispensable part of systemic science. But, given that the outside or 'objective' stance always rests on a specific point of departure, it is not the privileged, value-free, Archimedian point of observation that is the implied in the ideal objectivity of natural science. Moving from the inside to an outside view in systemic research, approaching the position of the objective observer, allows for a distinction between intentional and causal dynamics – leaving further observed system dynamics uninfluenced by the researchers intentions, and thereby allowing for learning about the causal dynamics. And taking an outside view of the research process

importance for the self-reflective learning process outlined here - though it is by no means obvious which organisation is preferable.

further allows for an ‘objective’ description of the specific point of departure of the research, which can be communicated.

The experience of the researcher becomes ‘objectified’ by being transformed into scientific communication. In this transformation process, the researcher approaches the stance of an ‘ideal’ observer so that this ‘objective experience’, in principle, can be shared with any member of the scientific communicational community. The demarcation of science as a special learning process, I suggest, is this ability to take an 'objective' stance – not the conventional, un-reflected objectivity, which focused on the exclusion of the intentional aspects, but a 'reflexive objectivity' that includes the intentional aspects and exposes their role. The characteristic of reflexive objectivity is that the false assertion of value-freedom is less objective than the admittance of the values and intentions involved in science. Hence, learning in systemic research should acknowledge that the values and intentions of ‘phenomenological’ starting point could be decisive for the research and that this starting point therefore should be well-defined and clear, and that it furthermore should be included as a necessary context for the subsequent ‘objective’ stance and the (internal and external) communication of experiences from this stance.

As described above, Luhmann considers science as a functional subsystem of a differentiated society (see figure 2), which structures its communication through the binary code of logic: the difference between true and false (Luhmann, 1989:76f, 36f). However, this seems only to capture one aspect of scientific learning having to do with the peer criticism of the scientific community - the aspect of science as the experiential learning of a cognitive system is ignored.[11] In the perspective of the self-reflective learning process of systemic science, the possibilities for peer criticism seem more constrained than the simple binary code of true or false suggests, since ‘the truth’ becomes dependent on the cognitive context including the values and intentions involved. The objective of the peer criticism of the scientific community, as opposed to the general discourse of society, is to subject the

[11] In comparison, the naturalistic approach of John Dewey entertains a much broader concept of logic than Luhmann's binary logic, a concept that corresponds to the concept of inquiry. And this is connected to a general principle of contextual analysis, which requires that the process and product of inquiry (here: learning and knowledge) be taken as correlative distinctions, so that neither can be understood or assigned a status in existence without the other (Ernest Nagels introduction in Dewey, 1991:ix-x).

knowledge of the individual researcher or research group to the perspectives of other researchers, and thereby root out errors due to the influence of the individual perspectives.

As generally recognised in light of today's specialised sciences, peer criticism is only in principle open to the scientific community in general. In practice peer criticism is conditioned upon special knowledge and therefore restricted to disciplines or sub-disciplines in science. Insofar as the intentionality and values of scientific inquiry are included as necessarily relevant in the scientific communication of systemic science, this will also, in practice, constrain peer criticism to those able and willing (at least for the time being) to entertain these intentions and values. Research in organic farming, as an example, presupposes the undertaking, at least to some extent, of the values and goals of the organic movement. In order for peer criticism to take place, these intentional aspects need to be addressed and described, and the peer critics must be willing to judge the research on this basis. On the other hand, it is only by the inclusion of this intentional context that genuine peer criticism can take place according to the criterion of reflexive objectivity.

5. Sustainability as an example of the role of values in systemic science

Apart from the description of the intentional aspects of research, the role of values in systemic science can include sociological investigations of values, conceptual analyses of value-laden concepts[12], and philosophical work on ethics and value theory[13]. These are different aspects of what we can call ‘value inquiry’.

As an example of the role of values and rationales in systemic science, we can look at the meaning of the concept of agricultural sustainability. Researching sustainable agriculture, we find a variety of meanings of sustainability in agriculture and society. Gordon Douglass (1984) made it clear that ‘agricultural sustainability’ means different things to different people, and that it can be defined in different ways and sought through different means. Douglass distinguishes between three dominant

[12] An example of this is the analysis of the concept of animal welfare in connection with organic faming (see for instance Alrøe et al. “Does organic farming face distinctive livestock welfare issues” – please email me for a preprint).
[13] See for example Alrøe & Kristensen: "Towards a systemic ethic. In search of an ethical basis for sustainability and precaution" - please email me for a preprint.

visions of agricultural sustainability: food sufficiency, stewardship and community, which are used by different groups with different views and values. Sustainability as *food sufficiency* looks at population growth and speaks of sustainability in terms of sufficient food production, with the necessary use of technology and resources. Agriculture is an instrument for feeding the world and economic cost-benefit analysis is the instruction, which guide application of that instrument. In this group we find the defenders of the modern ‘conventional’, industrialised agriculture. Sustainability as *stewardship* is concerned with the ecological balance and the biophysical limits to agricultural production. From the ecological point of view, sustainability constrains the production and determines desirable human population levels. This is a diverse group of ‘environmentalists’, often with a concern for the limits to growth in a finite global environment. Sustainability as *community* resembles the ecological point of view, but with special interest in promoting vital, coherent rural communities. Cultural practices are taken to be as important as the products of science to sustainability, and the values of stewardship, self-reliance, humility and holism are encouraged. In this group we find the ‘alternative’ forms of agriculture, and modern organic farming has also originated from within the community group.

Within the philosophy of sustainability, Paul B. Thompson (e.g. 1996) distinguishes between two, and only two, philosophical meanings of sustainability: resource sufficiency and functional integrity. This distinction corresponds to the difference between distinctive and systemic conceptions of human’s relationship to nature (Alrøe and Kristensen, 2000b). There are two opposing views of nature within the distinctive conception, which can be characterised as “the agriculturist's” and the “naturalist's” perspective. “The agriculturist” values nature that is controlled, well-ordered and useful to man, while “the naturalist” values the wild and authentic nature, which is un-touched by man. In the systemic conception the value of nature is found in the intimate, mutually benign processes between human and nature. Sustainability as *resource sufficiency* implies an instrumental relation to nature, with a focus on the foreseeable use of resources, food production and food distribution. In *functional integrity*, agriculture is seen as a complex system of production practices, social values and ecological relations, where the functional integrity of the system can be nurtured or disrupted by human practice. Sustainability in this sense supports strategies for increasing the resilience of the system and avoidance of irreversible changes, and is therefore closely related to the concept of precaution (see e.g. Boehmer-

Christiansen, 1994). Resource sufficiency is related to ‘the agriculturist’ view within a distinctive conception of nature, while functional integrity is related to a systemic conception of nature.

How can agricultural science handle the different meanings of sustainability and the different values, rationales and metaphysics (or worldviews) involved? Conventional agricultural science, with its un-reflected natural science heritage, lends itself to the resource sufficiency approach, because they share the same instrumental, objectivist approach. But it backs away from the functional integrity approach to sustainability, because this approach implies questioning the conventional rationale and methods of science as well as of agriculture. Researching sustainability as functional integrity cannot be done from an entirely objectivist stance, because this understanding of sustainability presumes a phenomenological stance towards nature. The researcher needs to assume a position within an integrated socio-ecological system to see the values inherent in functional integrity, such as for instance a precautionary attitude as opposed to that of conventional ‘scientific’ risk assessment.[14]

The reflexive systemic science must analyse these conceptual differences and investigate their use and meaning in society and relevant groups or subcultures. On this basis will it be possible to initiate research on agricultural sustainability, which is relevant to, for example, the organic farming movement. But a reflexive systemic science must involve an objective stance towards the values and intentions of groups in society by way of value inquiry in a broader, philosophical sense, and investigate for instance the ethical basis for sustainability and precaution.

6. Criteria of scientific quality in systemic science

Before discussing the implications of the perspective on science presented above for the criteria of scientific quality, it might be relevant to point out that not only all applied sciences, but all experimental sciences as well, share a certain systemic character. All the predictions of experimental science are of this nature: If we do this, or if we realise this hypothetical situation, then this will

[14] See further in “Towards a systemic ethic”.

happen.[15] The scientific answers are found by way of manipulating the subject area, either hypothetically, as in mathematics and thought experiments, or physically, as in experimental research. But the manipulation of experimental science in general rises only epistemic concerns. The epistemic difference between what I have called systemic and 'objective' sciences is, that where an 'objective' science can ignore the influence of its work without hampering the scientific progress[16], the systemic science cannot ignore its own influence without hampering the scientific progress, because it influences its own subject area. This epistemic concern is acknowledged in the conventional scientific criteria on documentation and reproducibility of research methods.

Apart from such epistemic concerns, and related criteria of scientific quality, there is also an ethical aspect of systemic science. Self-reflection in science is the prerequisite for science being able to be socially responsible. This goes for all types of science, though some scientists and sciences might deny that there is a social responsibility attached to their work. Both systemic and ‘objective’ sciences can be more or less reflexive, but when a reflexive ‘objective’ science begins to address its own influence on society or nature, it transforms into a systemic science, because it shifts its subject area to include the areas that it influences. The question: “Do we want to do this – do we want to realise this hypothetical situation?” becomes an ethical concern only when the action has actual or potential consequences for society or its natural environment. In this case, the influence of systemic science on its subject area is not only an epistemic but also an ethical concern.

Considering science as a social system, there are some communications that refer only to the scientific system itself and not to the relation with other social systems. Among these characteristics are some that determine science as science, and which therefore give rise to criteria of good science or good research. We can call these criteria ‘internal’ criteria of scientific quality. Among these are the conventional criteria of science such as objectivity, documentation of methods, reproducibility of results, testability of theories, etc. The ‘reflexive objectivity’ suggested above implies a modification of these internal criteria to suit the systemic sciences, emphasising the need for determining and exposing

[15] Note that experimental science involves a similar circle to the one in figure 3 (even though the term self-reflection is inappropriate), but experimental research starts in the objective position, then moves into an active position in the system – setting up the experiment – and then moves back to an objective stance, observing the results.
[16] Leaving this 'scientific progress' as a vague notion for now.

the intentional or value-laden aspects of science. In the perspective of systemic science, there are also external criteria of good science, which are connected to the relationship between science and society. The term *relevance* can be used as a common term for these criteria. This term indicates a view of science as a learning process for society where good research is characterised by being relevant and useable (in a wide sense) to society. But a modern society consists of different groups and subcultures with different views, rationales, and values. Therefore the simple criterion of relevance is insufficient. The relevance of systemic research depends on the intentional or value-laden basis of research, and therefore the needed development of the (external) criterion of relevance turns out to share common aspects with the (internal) criterion of reflexive objectivity. Below are some suggestions for aspects of scientific quality that are shared by the criteria of relevance and reflexive objectivity:

– research should investigate and explicitly describe its own *point of departure*: the viewpoint and values entailed in the research project
– and reversely, research should *engage* in the problems to be investigated, working explicitly with the goals and values involved in its subject area
– research should describe the choices made, the delimitations and constraints involved, and the areas of ignorance uncovered in the particular project, as a necessary *context* of the results produced
– research should place itself in a *larger perspective*, in order to facilitate the use and critique by different users and researchers with different perspectives.

7. Conclusion

Focusing on the systemic sciences that are involved with society or its natural environment, we may draw the conclusion that any such systemic research project involves some necessary (but not necessarily explicit) choices on which intentions or values to take as a basis for research. And that the public openness towards critique (which is still a fundamental criterion of science) is conditional upon the reflection and communication of this value-laden ground. Hence, the objectivity criterion in systemic science becomes a criterion of *reflexive objectivity*, which includes the intentional aspects of science and exposes the role of values. The internal criterion of reflexive objectivity may be considered a criterion of demarcation of science as a learning process, which takes account of the necessity of a specific point of departure for the ‘objective’, self-reflective stance in systemic science, as well as for the need of including the intentional or value-laden context in the communications of systemic science. Further criteria of scientific quality have been suggested, which contribute to reflexive objectivity as well as to the external criterion of *relevance* in a modern society consisting of different groups and subcultures with different worldviews, rationales, and values. The 'somewhat privileged' position of science is ensured by the characteristic scientific *openness* towards the potential for further reflective stances – as implied by the critical approach of pragmatic fallibilism – which may or may not change the current scientific position with respect to the criteria of relevance and reflexive objectivity.

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