Automation systems for farm animals: potential impacts on the human-animal relationship and on animal welfare

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AUTOMATION SYSTEMS FOR FARM ANIMALS: POTENTIAL IMPACTS ON THE HUMAN ANIMAL RELATIONSHIP AND ON ANIMAL WELFARE

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Abstract

This article discusses ethical issues raised by automation systems in animal farming. These systems automatically collect various kinds of information about an animal and allow the farmer to monitor it remotely. It is argued that the relationship between the farmer and the individual animal is becoming increasingly distant and impoverished. Although this may protect the animal from some negative interactions, it is less clear whether use of these systems will lead to an increase in positive interactions of the kind beneficial for animal welfare. Furthermore, the measurement of specific parameters replaces observation of the animal as a whole, which may affect the perception of the animal. As automation systems replace traditional tasks, the role of the farmer is changing drastically. This may lead to deskilling in the farmer, which in turn may affect animal welfare. The value of automation systems in increasing productivity is clear; however, this paper questions the extent to which these systems can be used to enhance animal welfare. It is argued that ethically acceptable development of automation systems for farm animals can only be achieved if these systems prove to be beneficial in respect of animal welfare.

Key words: animal welfare, automation systems, ethic, human-animal relationship.

Introduction

Automation systems (AS) were first used in animal husbandry in the identification systems of the late 1960s. In the mid-1970s, the first computer-controlled feeding system was manufactured by the Dutch firm DACA. During the 1980s, integrated circuit (IC) technology permitted the miniaturization of transponders. As the size of farms increased, radio frequency identification (RFID) helped farmers to identify a single animal in a large group, decreased labor costs, and improved working conditions (Rossing 1999). Later, in the 1990s, a third generation of sensor technology began to be developed. These sensors were designed to store data on, for example, the medical history of the animal, and to
monitor health and performance (Eradus and Jansen 1999). Given the increasing demand for traceability and new regulations governing group housing (e.g., the European Council Directive 2001/88/EEC), the value of AS is clear.

In this article, “AS” refers either to software systems that make direct use of this third generation of sensors (the data being collected through a sensor attached to the animal); or to systems that collect information about an individual animal wearing an identification tag (and in this way, for example, recognized at the milking parlor or feeding station), or to other systems that remotely gather data about a specific parameter. These systems collect, transfer, and analyze information about a single animal, so that the farmer is informed about the state of that animal at all times. They can replace various traditional tasks of husbandry: estrus detection, weighing, and milking can now be automatically performed by AS. Current AS answer a desire to increase productivity: by a better control of reproductive performance, by allowing individual animal health status to be monitored, by improving the economic return in facilitating the delivery of more homogeneous products, and by reducing labor costs. Although a few AS have been developed for extensive production (for animal tracking using GPS, for instance; Rutter, Beresford and Roberts (1997)), this article focuses on modern intensive animal husbandry. In developed countries, the great majority of animal production units are intensive, and it is on these farms that most AS are currently being implemented and developed.

The use of AS in new methods of production may affect the stockman, the welfare of animals, and the relationship between the stockman and the animals. The importance of the Human–Animal Relationship (HAR) upon animal productivity and welfare has been studied for various species: for example, Hemsworth and Coleman (1998) for livestock, more recently Breuer et al. (2000) and Breuer, Hemsworth and Coleman (2003) for dairy cows, and Hemsworth et al. (1999) for pigs. The methods for assessing this relationship has also been recently reviewed (Waiblinger et al. 2006). The fact that labor-saving technology (replacing traditional tasks of husbandry, as, for example, feeding) tends to further reduce contact time between stock persons and animals has been mentioned (Rushen, Taylor and de Passille 1999), but the influence of these technologies upon the agents involved in animal husbandry (farmers and animals) has not yet been the object of deeper discussion.

Consumers are becoming increasingly aware, and critical, of the conditions in which farm animals are raised, especially with regard to welfare issues (Lassen, Sandoe and Forkman 2006). If consumers’ views of animal welfare are to be taken into consideration, it is argued that the interest and credibility of AS will depend not only on the extent to which automation systems improve animal welfare, but, before this, on a demonstration that such systems do not themselves lead to reduced welfare. The potential value of AS in reducing labor costs and improving productivity make their development within animal farming
most likely; the issue is whether it would be ethically correct to employ AS when they risk altering animal welfare for the worse.

In this article, it is questioned whether the implementation of AS is beneficial for both the farmer and the animal. What impact do automation systems have on the farmer, the animal, and the relationship between the farmer and the animal? To what extent can they be employed to benefit animal welfare?

The following section discusses the impact of AS upon the HAR, and some of the potential consequences upon animal welfare. The final section discusses other impacts that AS may have upon animal welfare, farmers, and consumers.

The impact of AS on the HAR and their consequences on animal welfare

A major potential impact of AS is an increase in distance in the farmer–animal relationship, a distance already impoverished, especially in large-scale farms. This is a result of the remote monitoring of the animals: farmers need not observe the livestock as closely as before, since information about individuals is transmitted directly to a computer.

Suppression of some of the routine farmer–animal contacts can reduce some potential negative interactions. For instance, violence towards an animal may be threatened or committed in the process of moving the animal. AS can contribute to avoidance or reduction of this violence in that it can sort, move or weigh animals automatically (using e.g., electronic gates) without human contact, and so protect the animals. It should be stressed that the relationship between the farmer and the animal also affects the farmer, since her/his handling of animals will be carefully scrutinized by society. Therefore, it can be argued that avoidance of these potential negative interactions may give the farmer more credibility in society.

Nevertheless, AS may result in more negative than positive human–animal interactions being performed. While the opportunities for positive interactions with livestock are replaced by AS (e.g., manual feeding replaced by automatic feeders, milking replaced by milking robot), some aversive tasks resulting in stress and/or pain for the animal, such as vaccination or castration, still require human intervention.

Overall, interactions between the farmer and the animals—both positive and negative—tend to become scarcer. Housing systems in which AS are implemented and/or assist implementation tend to further reduce potential interactions: for example, in larger groups, AS can help give an individual animal more space in which to avoid people, so that human–animal contact becomes more difficult. Also, there is a tendency to find alternative
ways to attract and manipulate the animals in current AS; for example, by using music, instead of walking among the animals, to encourage the cows to walk to the automatic milking parlor (Uetake, Hurnik and Johnson 1997).

However crucial more space is for animal welfare, a consequence of this reduction of regular human–animal contact is that the animal becomes less habituated to people. As a result, contact with humans could become more distressing, thereby increasing stress and fear of humans (Rushen, Taylor and de Passille 1999) and hence reduce animal welfare. This will be a major problem when an animal needs to be treated for disease, for example. As Hemsworth and Coleman (1998) state: “another potential problem for animals that are deprived of human contact is the fact that, if any human contact is required, perhaps in an emergency situation, this interaction will be highly fear-provoking and aversive.”

To improve the HAR and hinder animals from developing a fear of humans, several authors have suggested two main solutions: 1) encouraging positive human–animal interactions, and 2) ensuring a positive attitude/behavior of the stockperson towards the animal.

In connection with dairy cows, Raussi (2003) suggests that attempts should be made to ensure that there are, on balance, more positive interactions than negative ones to discourage animals from developing a fear of humans. This author also suggests that the behavior (and indeed the mere presence) of the stockperson influences the animal’s fear of humans, and points out the importance of having a person who is well trained to handle the animals. Waiblinger et al. (2006) suggest that both productivity and animal welfare can improve in systems that involve regular, intense, and long term human–animal contact. These authors also suggest modifying the farmers’ attitudes and behavior through educational initiatives to alleviate the animals’ fear of humans and to promote more positive human–animal relationships. According to Rushen, Taylor and de Passille (1999), solutions for reducing animals’ fear of humans are found in the stockperson’s behavior. Hemsworth (2003) reports that training programs targeting attitudes and behavior of stockpeople have a direct effect on animal fear, welfare and productivity. Another solution would be to completely automate the stockperson’s functions; in that way, any adverse human–animal interventions could be avoided (Hemsworth and Coleman 1998). This last option is, however, not yet realistic, since particular interventions (vaccination, castration, treatment in the case of diseases) still require human contact. Finally, Anthony (2003) is also in favor of improving the human–animal bond, which may not only benefit the animal (by reducing fear and stress) but also the farmer, whom by frequent and close contact with the animal may get more familiar with the animal’s disposition, needs, and behavior, potentially resulting in better detection of the animal’s welfare.
According to the level of automation, AS have the potential to allow farmers to spend physically more time among their animals, as it reduces the time spent carrying out repetitive and laborious operations. The question of how this time is best used needs to be addressed. Frost et al. (1997) review developments in the use of sensors for animal farming. These sensors provide information about animal weight, animal identity, animal behavior, physiological factors, environment factors, and body conformation and composition. They use, among other things, image analysis, electronic odor sensing, and acoustic monitoring. Is there any remaining need to look at the animal directly when all this information can be automatically collected? What should any time spent directly observing livestock be used for?

It has already been suggested that the implementation of AS may result in a growing distance in the farmer–animal relationship. To put it in perspective, the already existing distance may have been necessary in modern animal husbandry. According to Rothschild (1986), such a distance may have been, and still be necessary in raising farm animals: “Just as we have to depersonalize human opponents in wartime to kill them with indifference, so we have to create a void between ourselves and the animals on which we inflict pain and misery.” Hence, more positive interactions, and more time spent among his animals, might bring the farmer closer to them. The question raised here is how would the farmer respond to more time with her/his animals, if this distance is inherent in animal farming? Also, will the implementation of AS merely facilitate and increase this void, and as a result make the farmer react in an even more distanced manner to an animal in distress? And is it at all possible for the farmer to get closer to the individual animal, especially in a context where the number of animals per stockperson is constantly increasing?

Some of the issues discussed in this section (e.g., the further impoverished human–animal relationship) seem to go beyond the ones raised by the sole implementation of AS, and refer to some extent to the level and consequences of intensive systems. A reason is that both AS and intensification have developed concomitantly: AS facilitate large scale herds, and larger scale herds demand new monitoring systems. Nevertheless, reflecting on these issues is very important if AS should not only be a vehicle for further intensification, but also a vehicle to solve some of the animal welfare issues resulting from intensification.

**Other impacts of AS on animal welfare, farmers and consumers**

*Potential Positive Impacts*

Better monitoring of the individual animal seems a priori beneficial for animal welfare. Firstly, automated monitoring of the health status of dairy cattle (Thysen 1993; de Mol and
Ouweltjes 2001) or pigs (Madsen and Andersen and Kristensen 2005) can enable earlier and better detection of diseases, which in turn allow earlier treatment and, consequently, welfare improvement. These improvements concern the individual animal and/or a group of animals. Secondly, existing AS can also allow new methods for assessing animal welfare to be implemented. For instance, automated weighing of cows inside a milking robot appears to be a reliable tool to detect lameness (Pastell et al. 2006). Thirdly, AS such as milking robots, may help make routine tasks more homogeneous, thus avoiding potential variation from one stockperson to another when they perform the tasks. Finally, the use of AS permits “management by exception.” That is, they provide farmers with information that helps them to focus on specific individuals in a group. In that sense, AS may assist the development of systems perceived as more “welfare-friendly,” such as group housing, by allowing each animal to still be individually monitored. The fact that group housing allows, for instance, freedom of movement may help reduce chronic discomfort and hence contribute to the welfare of the animals.

With regards to farmers, the implementation of AS seems also a priori directly beneficial to them. Improving productivity results, labor conditions, and as mentioned above, animal welfare, can increase the work satisfaction of the stockperson. These potential improvements, especially with regard to animal welfare and the conditions in which animal are raised, seem also to be in the interest of the consumers.

**Potential Negative Impacts**

Even though data registration is already part of animal farming, it is suggested that increasing automation may result in a growing quantification/objectification of the animal. Efforts in the production system may tend to be oriented towards the improvement of specific parameters measured by AS, without necessary contact with the individual animal. This may in turn affect the attitude, and subsequent behavior of, farmers towards their livestock.

Farmers will need to prioritize new tasks, such as maintenance and management of the sensors, to ensure that the information being collected is accurate. As a result, they may depend more and more heavily on the sensors and the overall system controlling the herd. This growing dependence of farmers on computer systems may, in turn, influence their work satisfaction and increase stress. Forester and Morrison (1994) point out that the use of “computer systems can also degrade the quality of working life through 1) deskilling of the workforce, which reduces control responsibility and job satisfaction; 2) increasing stress, depersonalization, fatigue and boredom.” Thomson and Schmoldt (2001) write that it is during the interim period—that is, the lag between the implementation of software and its assimilation by those who are required to work with it—that negative impacts on human
quality of life are often recognized. In the present case, this interim period may be associated with more time spent learning how the automation systems in question operate and/or controlling the sensors. This may have a negative impact upon not only the performance of the traditional work carried out but also upon work satisfaction. As a further step, it is suggested that the modification of the traditional role of the farmer and a potential deskilling of the workforce risk decreasing the need for husbandry specialists.

In response to the alarms given by AS—when information that an individual is detected sick is received via a computer—the farmer should be able to give special attention to those animals. An initial issue here is that too much reliance on the sensors may lead the farmer to overlook problems that are not detected by the sensors. Also, it should be questioned whether farmers would respond as readily or efficiently to an alarm set off by a computer as they would if they saw for themselves that the animal was in distress. This remote monitoring of the animals may risk impairing the sensitivity of farmers towards their livestock, and make them less capable of taking action to treat the individual animal. Taking no action towards an individual as the result of a lack of sensitivity might be perceived as less ethical, or worse from the societal point of view, than not treating a sick animal whose illness went undetected due to inattention or negligence. Farmers need to be aware of the risks, both of overlooking other problems and/or of taking no action when an alarm is given.

If the farmer should focus on the individual animal instead of the batch or herd, how sick should an animal be before receiving a treatment? Lassen, Sandoe and Forkman (2006) suggest that “people with a background in modern animal production will probably have a bias towards focusing on the average.” Also, veterinary costs may in some cases make the farmer reluctant to provide individual treatments, especially where decisions are mainly taken at the “batch” level: where priority is given to the productivity and/or welfare of the group, rather than to the individual animal. Therefore, it can be suggested that implementation of AS should come with a change of vision of livestock. Focus needs to be more oriented towards the individual animal, instead of the group of individuals, as currently occurs.

There are various ways to reflect on the welfare of farm animals, for those who attempt to enhance it. One way is to look at production-related diseases resulting from intensification, to enquire into the reasons for an animal’s distress, and to reconsider the basis of the overall system. However, most current AS aim to control sickness and dysfunctionality as soon as possible, in order to prevent outbreaks of disease and reductions in welfare within the current intensive production systems. An illustration of this is the development of an AS that, by monitoring water consumption, prevents the outbreak of diarrhea in young pigs
(Madsen, Andersen and Kristensen 2005). As Settle (2000) mentions: “Farmers can now be much more remote from their animals…[The] scientist and the vet between them can now show the farmer new ways to stress animals for profit without actually making them sick—or dysfunctional for the farmer’s purposes.” By means of better and faster monitoring of production diseases, some AS can hinder welfare problems that reduce productivity, without promoting better animal welfare, as such. Too much focus on animal productivity risks reducing AS merely to a control tool that maximizes profit. In this way, animal husbandry can be seen as developing in the way that other forms of industrial production have. The main associated risk is to treat our animals, even more than we already do, as products. The reduction of the animal to a machine that is monitored by a battery of sensors will undoubtedly trigger increasingly hostile public opinion. Moreover, the fact that in 1997 the European Union recognized animals as “sentient beings” makes this evolution in our perception of animals ethically undesirable.

**Conclusion**

The use of AS in modern animal husbandry seems at first to be only positive for animal welfare. These systems may, for example, allow earlier and better detection of diseases, and assist the development of more “welfare-friendly” housing systems. However, it has also been argued that current AS may 1) affect perceptions of the animal, which tends to be seen merely as a product or as a combination of parameters to monitor; 2) risk modifying the farmer’s role, in the sense that he/she would need to develop expertise in controlling sensors and may lose the caring skills of a stockperson; and 3) impair the already impoverished relationship between farmer and animal, which may in turn affect the sensitivity of the farmer to the animal and be detrimental to animal welfare. These three elements are closely connected, since the new perception of the animals encouraged by AS may influence farmers’ relationships with their livestock, especially if their role is also affected. Therefore, it is extremely important to reflect on the ethical issues which AS raise. It must be asked whether automation systems truly benefit the animals themselves, the consumer (who now seeks traceability and is more than ever aware of farm animal welfare), and the farmers who use them.

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References


