VIDEO IMAGE ANALYSIS AND ANIMAL WELFARE ON FARM

S Barbera

Dipartimento Scienze Zootecniche — Facoltà di Agraria,
Università di Torino, Via Leonardo da Vinci 44, 10095 Grugliasco (TO), Italy

Contact for correspondence and requests for reprints: salvatore.barbera@unito.it

Abstract *Animal Welfare 2003,* ***12***: 513-515

The management of farmed livestock frequently creates situations of stress because of the periodical necessity for handling procedures (weight and linear measurements, veterinary procedures etc). Some of these practices can be avoided using technologies that obviate the need for direct handling. This can improve animal welfare and reduce risks to the handlers. Video image analysis is a technique that can be used for linear measurements and morphological evaluations required for growth trials, genetic studies or herd-book records. This paper describes the application of video image analysis to linear measurement and shape assessment in horses and cattle with minimal disturbance to the animals.

Keywords: *animal welfare, cattle, horse, video image analysis*

Introduction

It is known that some interventions can disturb the natural behaviour of animals and may cause sufficient stress to impair their welfare. Many of these practices which involve animal handling are essential routines on farms or in experimental units (eg weighing, sample collection, routine veterinary procedures). All of these interventions are potentially stressful to cattle, horses and pigs, and dangerous for the operators. To avoid these problems, to reduce costs, and in the absence of effective alternative technologies, many operators resort to subjective evaluations.

Video image analysis is a technique now in common use in industry as an alternative to handling procedures. The advent of low-cost hardware (eg computers, graphics cards, frame grabbers and digital cameras) with improved performance makes it a realistic proposition to extend this technique to the evaluation of growth and other linear parameters in farmed livestock.

To date, a number of experimental applications have been proposed in the sector of animal production and they generally reduce manipulation of the animal in comparison to traditional methods. The applications *in vivo* are aimed at the survey of linear or angular measures, whether static or during movement, on cattle and pigs (Patterson 1990; Brugiapaglia & Barbera 1991; Schofield 1993; Barbera 1995, 1999, 2001; Barbera *et al* 1995, Zehender *et al* 1996; Brandl 1997). These studies have been based largely on the use of computer technology to automate the collection and analysis of traditional linear or angular measurement. However, the method has the potential to explore new parameters that may

© 2003 UFAW, The Old School, Brewhouse Hill, Wheathampstead, Herts AL4 8AN, UK

https://doi.org/10.1017/S0962728600026105 Published online by Cambridge University Press

correlate with the desired measure of growth or body composition. This paper describes the application of the method of video analysis to the morphological assessment of cattle and horses.

Methods

A range of devices and software has been used for the study of live cattle and horses, including:

1) Photographs or video cameras — digital models have allowed for higher quality images and simpler management. Traditional photographs have been used; however, their analysis has been more laborious.

2) PC and graphics cards for image processing — the image processing is constrained by the speed of the hardware and the resolution of the frame grabber and graphics card.

3) Frame grabbers or scanners to operate on traditional photographs — in the case of video it has been possible to acquire single frames, with good results for digital video, while quality has been lower for traditional photographs.

4) Hand-held laser distance meters — useful for determining the distance of filming and for calibrating the image processing software; in the absence of this device pictures can be taken at a fixed distance.

5) Commercial image processing software — for analysis and to take of measurements of the image.

Analysis of the image has been carried out on foals of the Haflinger breed and on cattle of Piedmontese, Italian Holstein and Charolais breeds and their crossbreeds (Barbera 1995, 1999, 2001). Different methods of acquiring pictures or video have also been studied, with respect to the changing costs and availability of devices on the market (Brugiapaglia & Barbera 1991; Barbera *et al* 1995).

Method 1

The photo or video camera is fixed at a known distance from the animal and a picture is taken of an object of known length in order to calibrate the image processing software. The animal is then led into position, with the sagittal median plane perpendicular to the camera. Development of this method to allow free distance involves putting some metric references on the animals themselves.

Method 2

A method has been developed that does not require fixed positioning of the camera with respect to the animal but relies on the operator to determine the optimal position from which to take the picture. This has been achieved using a hand-held laser distance meter, integral within the camera, which measures the distance at which the picture is taken. The software uses this information to adjust each individual image to a standard distance and thus a true measure of size.

In practice, the operator first takes a picture of an object of known dimension at a distance measured by the hand-held laser distance meter. Subsequent pictures of the animal are taken using a fixed focus. The operator decides upon the optimal position from which to photograph the animal according to its size, its temperament and whether it is housed or free-ranging. For each picture, distance is measured by the hand-held laser distance meter. The optimal positioning is with the sagittal median plane perpendicular to the camera.

https://doi.org/10.1017/S0962728600026105 Published online by Cambridge University Press

Animal welfare implications

The first method has been applied to the study of the morphology of horses and cattle (Brugiapaglia & Barbera 1991; Barbera 1995, 1999, 2001; Barbera *et al* 1995). This approach is suitable for horses since they are accustomed to handling by man. The photographs were taken during an annual breed meeting and the horses were well trained. The time taken to obtain images was similar to that necessary to measure height to withers using the conventional Lydtin stick. For cattle, it usually takes much less time to obtain a bidimensional image using method 1 compared to using the Lydtin stick. The animals are less stressed and the operator's risk is reduced. Method 2 is still under investigation and results are not yet available. Nevertheless, the method is valid in principle and should prove to be effective in practice. Moreover, it has the merit that animals do not need to be handled.

Conclusion

Video image analysis has the potential to make a number of routine measurements less stressful for animals on farms and in experimental units. The technology for obtaining and analysing images is available and affordable. Although further research is necessary to establish the accuracy of measurements, the approach holds considerable promise in terms of speed of operation, animal welfare and operator safety.

References

Barbera S 1995 L'analisi dell'immagine video applicata al rilevamento di misure *in vivo* e alla stima della resa nel bovino da carne. *Zootecnica e Nutrizione Animale 21*: 321-332 [Title translation: Video image analysis for the detection of some external measures *in vivo* and for carcass estimation in young bulls]

Barbera S 1999 Stima del peso vivo nel bovino da carne mediante analisi dell'immagine. In: *Atti LIII Convegno Nazionale SISVet, 16–18 September 1999, Montecatini Terme, Italy* pp 427-428 [Title translation: Live weight estimation in young bulls by image analysis]

Barbera S 2001 Video image analysis applicata allo studio del profilo nel cavallo. In: *Atti LV Convegno Nazionale SISVet, 20–22 September 2001, Rimini, Italy* pp 387-388 [Title translation: Video image analysis applied to the study of the profile in the horse]

Barbera S, Bosticco A, Concilio C and Tartari E 1995 Prototipo di strumento per la valutazione morfologica del bovino da carne mediante il rilevamento tridimensionale di misure. In: *Atti del XLIX Convegno Nazionale SISVet, 27 September–30 September 1995, Salsomaggiore Terme, Italy* pp 953-954 [Title translation: An instrument for size evaluation of beef cattle by tridimensional measurements]

Brandl N 1997 Measuring pig travel by image analysis. In: Bottcher R W and Hoff S (eds) *Proceedings of the Fifth International Symposium, 29–31 May 1997, Bloomington, Minnesota, USA. Livestock Environment 5(1)*: 461-467

Brugiapaglia A and Barbera S 1991 Nuovi strumenti per il rilevamento delle misure somatiche sui bovini. In: *Atti del Convegno nazionale 'Parliamo di ... produzione della carne bovina' Università degli Studi di Torino: Fossano, Italy* pp 155-165 [Title translation: New techniques for assessment of the external conformation of cattle]

Patterson D L 1990 Obtaining objective measurements of animal conformation by video image analysis. In: *Proceedings of the 4th World Congress on Genetics Applied to Livestock Production, 23–27 July 1990, Edinburgh, UK* pp 295-298

Schofield C P 1993 Image analysis for non-intrusive weight and activity monitoring of live pigs. In: Collins E and Boon C (eds) *Proceedings, Coventry, UK, 6–9 July 1993. Livestock Environment 4*: 503-510

Zehender G, Cordella L P, Chianese A, Ferrara L, Pozzo A, Barbera S, Bosticco A, Negretti P, Bianconi G, Balestra G F, Tonielli R and Del Pozzo A 1996 Image analysis in morphological animal evaluation: a group for the development of new techniques in zoometry. *Animal Genetic Resources Information 20*: 71-79

https://doi.org/10.1017/S0962728600026105 Published online by Cambridge University Press