BEHAVIOUR IN THE PRE-SLAUGHTER AND SLAUGHTER ENVIRONMENTS

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ABSTRACT

Progress made in pre-slaughter stock handling in the last 20 years. The research includes several studies on transported animals; yard designs for better animal movement in new Works and for remodelling old ones; improvements to animal flow by reducing dog numbers and using leader sheep; and increasing attention is being paid to the live animal and its ability to cope with stresses. Several deer slaughter plants have been set up but no plans or assessments of their design efficiency have been published.

The concepts lying behind the treatment of animals to be slaughtered still tend to be anthropormophic with minimal respect for the live animal. More adequate definitions of terms like welfare, handling stress, humane slaughter, pain and suffering are a priority for the Industry. The total farm to slaughter handling process needs more careful evaluation. From this exercise the Industry would be able to improve the quality of its products and justify an on-going role as a humane provider of domestic animal resources for the benefit of all people.

In 1971, I delivered a paper entitled 'Animal Behaviour in Works - Pertinent Behaviour Studies' at the 13th MIRINZ Conference (Kilgour 1971). After 17 years of research and practice it is important to update this statement to highlight the sensible as well as the unhelpful statements made since then, especially those made against the interests of farmers and their animals and which have hindered progress in the Industry. Lobbies have arisen which sometimes make poorly informed statements or have a very narrow perspective which does not assist the well-being of animals destined for slaughter. This paper presents the current state of the art.

THE CURRENT POSITION

I met Temple Grandin in 1977 and encouraged her, to continue her practical work in the field of Meat Works handling facilities. There are not many people with her behaviour interest, stock handling expertise, enthusiasm and will to succeed, and the world requires "experts" in Behaviour and Meat Packing Plant/Animal Facility Design.

A graduate student, Mark Vette, who had some experience in behaviour studies used the backpack video to look at sheep handling in the Meat Industry in New Zealand (Vette 1985). Is anyone else involved in documenting such basic information? Who is setting up small 'design and build' situations or by 'trial and error' is trying to assess the effectiveness of what engineers have already put in place? Are we much further forward than we were in 1971?

A number of engineering studies have suggested new systems for animal holding and slaughter presentation (Anon 1975; Giger and Prince 1974; Westervelt et al. 1974). Yet, considering the millions of animals put through the slaughter chains each year, the Industry is very remiss in its lack of research and genuine reflection on the condition of the animals during the time leading up to slaughter.

Engineers, architects and designers have paid scant attention to the literature because it is still scattered and hard to find and they have avoided adequate referencing to what is available. As a result they have duplicated the same ill chosen yard designs and handling features which were offered 20 years ago. As costs now matter and austerity measures are in place, ill-advised decisions based on short cuts are being made permanent in concrete or steel.

The refusal of those involved in Animal Welfare Studies to co-operate meant that though two Journals, 'Animal Regulation Studies' (Holland) and 'The International Journal for the Study of Animal Problems' (USA) were both begun at the same time, both ceased publication within a short period of time. A single journal might well have survived. Slaughtered animals, the Meat Industry and the struggling groups involved in research in this field were all short-changed by this calamity.

Well intentioned bureaucrats have left their legacy of rules and regulations, which are as likely to be as stressful as they are beneficial to workers and animals. Hughes (1976) argued that the decisions, even from an 'enlightened' document like the Brambell Report (1965) after further research have been shown to be about 50% correct (chance level) as to what animals, if given a preference would have chosen for themselves.

What are current attitudes towards slaughter animals? The former rather callous response of "Well, it's on its way to its death so what?" has been replaced with, "We must keep the stress levels, the pH levels or the percentage of PSE or the DFD meats as low as we can or it eats into our profits". It is monetary gain, mainly for those in the processing side of the Slaughter Industry which currently calls the play. Monin (1983) summarizing a CEC discussion on the slaughter of poultry makes this comment, "the interest we give to the suffering of slaughter animals is directly proportional to the strength of the cries during the slaughtering process and to the resulting inconvenience for us from this noise". A cynical statement perhaps but is it so far from the truth?

It is progress to have people with concerns about carcass pH or PSE in Meat Packing Plants, and there are spin-offs like experimenting further with leader sheep (Bremner et al. 1980). Banning dogs from the precincts of stock holding pens (Holmes 1984a) is slowly gaining

momentum. However progress in the last 17 years in research on behaviour and handling and in the general attention given to stock between leaving the farm gate and reaching the slaughter point, has been disappointing.

A BACKGROUND TO THE ANIMAL AT THE FARM GATE

Extensively run rangeland animals are infrequently handled. When handling does occur it is often associated with pain or stress, such as during branding, tail docking or even dipping by immersion or spraying. Large farm animals have good long-term memories and they will be easily distressed during yarding for slaughter. Animals housed indoors are more easily distressed. The extreme case is that of 'sweat box pigs' which are raised in a dimly-lit, isolated pen under uniform temperatures and perhaps even force fed. On movement to slaughter these animals must make the rapid major transition into intense light and fluctuating temperatures, meeting noise and the razzle-dazzle of modern life while being transported over varying distances to slaughter. This can result in cardiac failure (Lendfers 1970). Abattoirs for intensively farmed pigs or chickens should be built adjacent to the rearing and finishing units.

Taking peak-fit lambs at weaning off New Zealand hills and transporting them to the Works results in little animal trauma or distress but at times the muscular spasms consequent on electric stunning can lead to ecchymosis, unless the heart is fibrillated at the same time as electric shock stuns the brain.

Rearing conditions can have an influence on the pre-slaughter distress levels of the animals and the post-slaughter state of the carcass. To date there has been little systematic study of these factors. Most farmers have the messages that all cattle must be polled; all sheep must be dagged and clean; all pigs be without injury before being shipped for slaughter. The precautions now taken with live export animals highlight key learnings for all involved in the farm presentation of slaughter animals (Truscott and Wroth 1976; Grandin 1983a).

FROM FARM TO ABATTOIR

In 1970, Carding wrote of farm killed animal slaughtered under acutely stressful conditions *providing beautiful tender meat*, while the animal taken to the abattoir *in theory to be killed "hygienically" and "humanely" was not as tender* (my italics). Such comments highlight the importance of the journey, from farm to slaughter point. There has been some work done on transporting animals though there are few recent papers (Kent and Ewbank 1983; Kenny and Tarrant 1987). Having ridden 1,000 km in the pens with a truck load of weaned calves I can understand why. It is dusty and one gets covered with dried faeces (Kilgour and Mullord 1973). Some of the studies have been done, not from a general concern as to how the animal was coping with travel but from concerns about single economic factors such as bruising (Grandin 1983b).

Some pre-conditioning is undertaken with valuable stud animals before travelling abroad, but fewer precautions are taken with stock for slaughter. This complaint by people in the welfare movement is in some cases justified. Mixed groups of pigs fight in stationary vehicles (Blomquist and Jorgensen 1962). Some general behaviour studies have reported on animals during travel by road, rail or air. These have documented information about which way the different species stand, lie, whether or not they eat, their water requirements, in what ways and for how long they butt, bite or horn one another and what their stress profile is like (Hails 1978). There is often disagreement as to whether cortisol, adrenaline or some other index is a suitable guide to animal trauma during transport (Pearson and Kilgour 1980). Severe stress from the sampling process is avoided by using salivary cortisols (Fell et al. 1986).

Despite this information, animals still get bruised, go down and get trampled on, are squeezed and suffocated, get transport tetany, end up dirty, or even die as a result of transportation. Sometimes it is the human care which is at fault. At other times bureaucratic ineptitude, when regulations or set conditions designed for one country, are transferred across and made law in another without thought for the genuine animal requirements. Such inanities can imperil travelling stock.

While travelling with calves, some of these restrictive rules and their application were experienced (Kilgour and Mullord 1973). A required number of hours on the ground at one stopping place before being able to leave etc, when literally applied, meant travelling at quite inappropriate times for the animals, going too fast and arriving at destinations tired, hungry and after dark.

I consider that rules relating to stock handling, travelling and care should only be codified. If given legal status such rules must be easily modifiable when new information concerning the humane care of animals is reported. Old, no longer pertinent statutes are very hard to rescind or amend. In the final analysis, the humane care of animals will not grow out of legal requirements to do "good" things for animals. The "will to be humane" must be present in the animal caretaker (Kilgour 1978a).

Loading and unloading can be one important component in an animal's distress. Ramp slopes for pigs are often set by legislation eg. at 4 in 7 for external ramps and 2 in 3 for internal ramps in the UK. However, when pigs are observed, these slopes are too steep especially those which vibrate and "feel" insecure to moving animals. Bobby calves appear particularly disoriented after travel and often refuse to move down ramps.

THE PRE-SLAUGHTER ENVIRONMENT

"Livestock must be kept calm and quiet before slaughter and carcasses must be handled correctly to guarantee

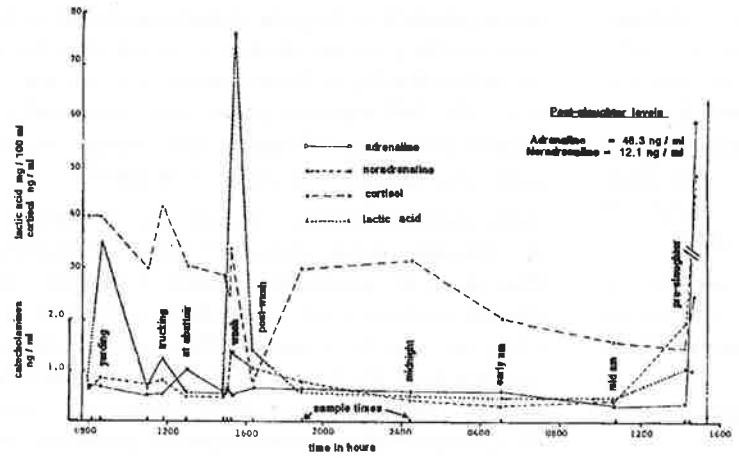

Figure 1. Profiles of plasma cortisol, catecholamines, and lactic acid averaged for eight lambs sampled on 15 occasions over 32 hours at times judged stressful for these animals: two before and during yarding; three associated with transportation; four during the inspection and washing; four during the course of the night and day holding period; and one each before and after slaughter.

meat quality" (Rhodes 1979). PSE and DFD meats are both indications that short or longer term stresses have been present for the animal at some time in the pre-slaughter environment, although some pig breeds are more susceptible. The challenge is to identify the cause of stress and locate the point in the complex handling process where they occur. Even when the cause is known (a high probability), translating this knowledge into specific changes such as breaking with traditional yard designs, improving stock handling, getting rid of dogs or highlighting the overall care of animals by tail board slaughter, less washing or no washing at all, is resisted by the Meat Industry. Cost has been cited as one excuse, but many handling changes could be implemented at no cost at all. Breaking traditions and overcoming human prejudice are involved.

There are improved yard design features which have been tried and tested (Grandin 1983b). Also available (Gradin 1984/85) are designs for sheep, cattle and pigs which will fit into the small spaces available when old Work's yards are being upgraded. Basic rules pertaining to handling animals are scattered in the literature. Lawton (1971) refers to the misuse of sticks, suggesting that electric goads when substituted are incapable of producing injury if used with prudence. Sticks leave bruises and injure eyes and other sensitive organs. He highlights the lairage injury of "spreading" caused when the hind feet of animals loose their grip on a slippery floor. The best floor designs, both for intensive housing of animals and in Meat Packing plants, deserve more research attention.

Pearson et al. (1977) took blood samples over 36 hours from sheep as they travelled from the farm to slaughter and developed profiles of plasma cortisol, catecholamines, and lactic acid (Figure 1). They highlight some of the stress points for animals during the pre-slaughter period. It is an indictment of those involved that the two most stressful points are during and post-wash and at slaughter. Sheep have an intense dislike of water, in part associated with the trauma of plunge dipping. The hide is more difficult to punch in sheep which have been subjected to wetting under the belly, let alone the full wash treatment (G. Colquhoun 1988, pers comm). After swim washes even shorn sheep are exhausted and their cortisol reserves are depleted (see Fig. 1).

Why wash anyway? I am told it is related to hygiene. Is hygiene so important in meat? Is washing the only way to achieve this? It may be important for its keeping quality. The irony appears to be that carcass contamination is more likely in damp animals than dry ones. Washing and double washing has an adverse effect on carcass ultimate pH.

Kirton (1976) reviewing any association between meat hygiene and human health could find no evidence of adverse effects on people in a country where meat is normally cooked before being eaten. The main role for hygienic requirements during slaughter appear to me to be either (i) a way for Veterinarians to keep a strong presence in the killing process, and preserve their jobs and influence or (ii) a political weapon used by some countries to provide protection for their own meat producers at the expense of more efficient or competitive producers (non-tariff barrier). A direct result of this obsession with meat hygiene has been that the costs of producing meats under current stringent conditions turn the product into a "gourmet" item and preclude its sale to many areas of the third world. Meat, as a protein source has costed itself out of the poorer markets.

The second traumatic event forced on the animal comes in association with electrical stunning. Such stunning,

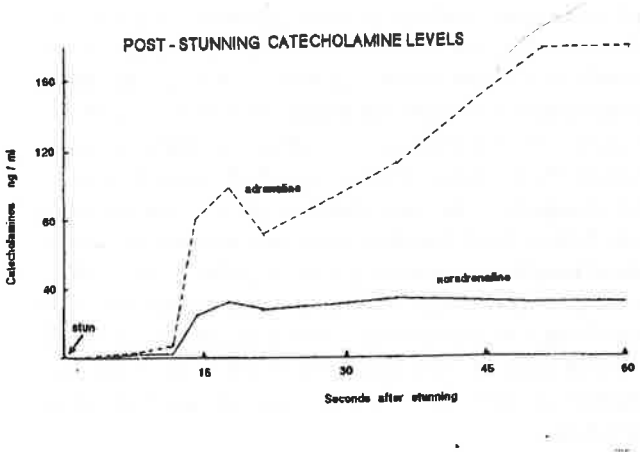

Figure 2. Plasma catecholamine profiles from lambs sampled nine times in the 60 seconds after electrical stunning.

done in the name of being humane, has only recently been shown to reduce pain awareness (Devine et al. 1987). The response of the brain and neural systems to electrical stunning is well illustrated by the catecholamine levels of sheep within 15 seconds after electrical stunning (see Figure 2). No other farm handling situation can produce a fraction of the output of these emergency secretions that an electric shock to body and brain will elicit.

Hygiene regulations on one hand and the concerns for being humane on the other, place the greatest stresses on sheep found at any time in the whole pre-slaughter process.

THE SEARCH FOR ADEQUATE DEFINITIONS

A number of supposedly self-explanatory terms are used to justify some of the procedures and handling practices in Meat Packing plants. A search of the literature for definitions of distress, pain and suffering in animals, signs of animal unconsciousness, humane slaughter, how hygiene and handling interact, what constitutes appropriate animal handling, whether tail board slaughter is in the best interests of animals and their welfare, or even the definition of animal welfare itself, turns up a hodge-podge of comment, circular definitions, and bad philosophic thinking. As a consequence of inadequately thought through opinions and inadequate concepts, millions of animals are forced to encounter current pre-slaughter conditions.

The AVMA panel on Euthanasia, the act of inducing painless death (1978) start their discussion at the point of the distress people feel on observing death in any form. This is a complex emotional response and such human distress occurs despite the fact that the person feels no physical pain. Because of this emotional content in the definitions we develop, their formulation becomes an extremely important activity.

I have argued elsewhere (Kilgour 1978b; 1985/86) that pairing the word "humane" with "slaughter" leads to logical contortion. To be humane is to save and sustain life, which is diametrically opposed to death. Slaughter is plain slaughter and cannot be more or less humane. To be humane, like our ancestors, we would creep up on our animals and shoot them outdoors. Processing them through present systems put in place because of tradition, efficiency for handling large numbers or hygiene rules, keeping them under strange crowded conditions near total strangers, noise and unusual odours, for up to 36 hours before final slaughter must be the most inhumane animal handling treatment yet devised by people. Why then the concern about whether an animal dies in 3 or 20 seconds after its blood is let? This is a ridiculously small period of time to elicit our concern when the total pre-slaughter process forced on the animal may last up to several days.

The pain involved in slaughter is another issue. Is the pain and stress involved in stunning an animal more or less equivalent to the pain of gash-cut slaughter in sheep? Add to this possible doubts as to whether the stunned animal under day to day conditions is really unconscious, since the full extensor phase recommended by Croft (1956) rarely occurs. Even the most practiced stunners at times stun animals twice (just to be sure!).

While running single sheep in the closed field test I found that the subordinate animals in the group started to die. Post mortem examination indicated that they had high plasma cortisol levels. Levels of cortisol at slaughter (Kilgour and de Langen 1970) varied and could be attributed to the length of the pre-slaughter handling period. Among the criticisms arising on publication of these results were that the cortisol response was much too slow and that the fluorometric assay was too insensitive.

When further work was done with the catecholamines (Pearson et al. 1980), the critics implied that it was not important if extremely high catecholamine levels were present after stunning as it would bleed out. More dramatically, none of the physiological measures made by scientists would influence people's thinking on humane slaughter. By definition, humane slaughter is "rendering an animal unconscious before its blood is let". It was only the definition that mattered. The contribution of science was discounted in the final analysis. The time spent on these experiments has not been wasted but I am more convinced than ever that the definitions we have are fundamental to our practice. To change them needs more than science.

Do animals suffer during slaughter? Thorpe (1965) defines suffering as "prolonged anxiety and imaginative anticipation of further pain". By this definition the answer must be "No". An animal must have experienced an event previously to suffer when it occurs the second time. This excludes death!!

I am reluctant to use the term Welfare. Welfare definitions in the literature are either patronising or so amorphous as to have no operational meaning. The word Humane redefined as "Imposing the least amount of distress on an animal, and to do this by knowing the needs and requirements of the species being dealt with" (Kilgour 1978a) is more adequate.

Complete chapters and books have been written to define stress and distress (Fraser et al. 1975; Moberg 1985; Stephens 1980). People speak of stress as though it was understood in precisely the same way by veterinarians, shepherds, or welfarists. The confusion over definition may be one of the reasons why PSE and DFD have been so hard to eliminate from our products.

A final comment on the importance of definitions is warranted. Inadequate definitions lull people into a position where vigilance is reduced. When a survey of 22 abattoirs all using pre-stunning methods accepted as being humane to animals, was conducted in Europe (CEC 1977), captive bolt stunning was judged to be poor

in 3; unsatisfactory in 3; adequate in 10; good in 5; and very good in 1. Half of the electric stunning of pigs was judged unsatisfactory and almost 60% of the CO_2 stunning of pigs was unacceptable. If there is a stated welfare concern for slaughtered animals (and in my opinion focussing all the concern for the animal at this late stage in processing is misplaced), more care must be taken with the mechanics of rendering the animals unconscious. Not only are some definitions associated with pre-slaughter lacking in clarity; because they are there, vigilance is reduced and poor practice may even be excused.

THE PRE-SLAUGHTER REQUIREMENTS OF EACH SPECIES

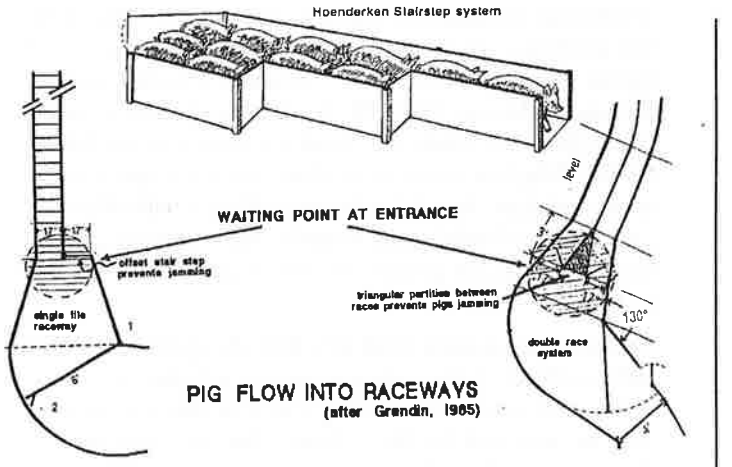

Figure 3. Single and double raceway designs showing the stair step (single) and flat facing wall (double) arrangements which prevent pigs from jamming in the entrance ways.

The current world large animal slaughter rate is about 50 per second (Blackmore and Delany 1988). Within this large scale process, how seriously is each different species of farm animals taken? After working in farm animal behaviour research for 30 years one question still remains for me - why do the 'English' keep laughing at animals? Cartoonists often use animals as a way of laughing at or commenting on the human condition. Each time I request serious public information to be prepared as a contribution to continuing education for farmers or animal owners, those preparing the brochures want to cartoonise the basic data. It remains an enigma - why do people keep on laughing at animals? Does the Meat Industry take animals seriously or do they also get hooked into this same societal phenomenon?

Each species has different requirements not only for its handling facilities but in the conditions under which the animals are held. The ethograms or behaviour responses of each of the farm species has been detailed elsewhere (Kilgour and Dalton 1984; Kilgour 1985). Pigs need to be slaughtered in a noisy environment. If a pig squeals, this call carries precise information and may well alarm the next group of pigs to be slaughtered. Do you have 'white' noise in your pig slaughter plants to drown out such effects? Some sheep slaughter facilities are excessively noisy. Dogs are barking and steel rattles or plastic bottles filled with stones may be used to force sheep to move. Cattle bellowing after being goaded and the inevitable machinery sounds make noise a serious pollutant in many cattle plants. The organisation of slaughter plants for deer range from those that slaughter animals on their arrival to those that hold the animals under a water spray system until killing.

Undulations in the floor underfoot cause swine to balk, but rarely affect cattle movement. Pigs and sheep jam at the entrance to single file chutes, while this happens less frequently with cattle. A triangular entrance with a flat facing wall beside which a pig can wait its turn will free up these situations (see Fig. 3). Common sense suggests a funnel design might overcome this problem, but in the industrial situation other designs are more functional. Some of the bottlenecks in sheep flow can be solved by changes to underfloor lighting patterns.

Some welfare enthusiasts strongly suggest that sheep should be isolated before they are slaughtered. All our work with sheep indicates that the minimum sociological group size within which sheep "feel" comfortable is four animals. Data from ram libido tests, the scattering rather than bunching of three sheep in dog trials, and data from experiments on grazing pressure and parasites in sheep all indicate that it is unwise to go below four animals per group if reliable information is to be extrapolated from sheep. Why isolate sheep for slaughter? It would add one more stress to them at an already stressful time. From a human perspective it might be nice to be killed quietly in a corner by yourself. This does not make good sense for sheep.

Leader sheep or goats are ideal for moving sheep in strange conditions. Could we train leader cattle to lead bovines to slaughter? Would there be any advantages? Pigs are difficult to herd. Who is doing the research on the easiest and most helpful plans for moving groups of swine? Raceways a little over 1 m wide appear to be usable for pigs of all ages. If people have to cross the lines of movement of pigs how should this be done? Can we bridge the raceway or should the pigs go through a tunnel?

Many simple questions like the placement of lights in animal handling areas are not so easily answered from first principles. Melbourne studies with sheep in raceways, indicated that if the leader sheep went from a lighted area into a dark alley, then other sheep behind followed (Hitchcock and Hutson 1979). If the leader balked, so did all the following sheep. Deer travel better if they are in dark conditions or blindfolded, and they can be worked more easily in handling facilities where the light is dim.

Melbourne research on sheep behaviour, stimulated by the Hopkins' principles of sheep handling, provided useful information for those designing animal handling facilities (Hutson 1979; 1983). Reworking these same principles with cattle has started (Vowles et al. 1984a; 1984b). Much remains to be done on other species like goats and deer. Funds for this type of work with different farm species should come from the Meat Industry as they handle the biggest groups of animals and have the most to gain.

Problems associated with efficient sheep handling are still unsolved. Is there an easy way of getting sheep into a single file race? Hock bars to prevent sheep retreating may be practical in Meat Works but are little use on farms. Sheep hurt their front feet on them and become reluctant to travel that same pathway again. Leader sheep which work mobs of animals through pens in an efficient way, must have return races. Leader sheep take less time to be trained than dogs (Kilgour 1987). Will a circular revolving carousel at the entrance to the restraining conveyor be a good substitute for leader sheep? Some New Zealand works have taken this risk. Mirrors or a dummy sheep skin have limited roles (Franklin and Hutson 1982). Could we play tape recordings of bleating sheep to attract animals to key positions? Do we have to tolerate dogs with sheep because there is no other way to move them efficiently? We have hunches and suspicions about these questions. Barber and Freeman (1986) review plans for sheep yards.

As I examine meat plants I have many other questions. Why are sheep nearly always forced to move up hill to the point of slaughter? Is it because sheep like to do that or because the chain on which the carcass is hung needs to start from an elevated position? Logic rarely applies in these situations. There are few Works where cattle are forced up hill before slaughter.

People mix in with sheep all the time - cattle are moved by people on overhead walkways. There may be good reasons for such practises. Flags which can cover the eyes of individual cattle and allow their manipulation within the mob (Holmes 1984b).

Is there a meat plant anywhere in the world which has begun their planning and design at the farm gate or unloading area? The real planning design normally starts with the chain. Do the animals and their welfare rate any concern at all? Are there other recent papers reviewing this area since my own (Kilgour 1978b)?

TRAINING LEADER SHEEP

Sheep are a "follower type" species (Kilgour and Dalton 1984). "Judas" sheep have been used in Freezing Works for decades, yet few of the newly discovered principles of learning have been applied to modern sheep "leader" training. Our techniques of leader sheep training use two avenues of behaviour control, shoulder blade scratching and nut feed (Bremner et al. 1980). The animals learned within a few trials to push through flap gates, wait for flocks of sheep to catch up before moving on again, to come on call, to stay when tied up or even to unlatch a gate. The first group trained for a new abattoir were rejected not because of our training but because the sharp angled steel floor destroyed their hooves within a few days. Distinctive coloured leader sheep are ideal as they can easily be seen. Few farmers have bothered with leader sheep which facilitate movement at the front of the flock, but instead spend many hours training dogs which apply pressure at the rear of the mob.

The role of leader sheep is not to overcome inappropriate engineering design or help redeem a badly designed handling situation, though of course they may do this. Sheep should be used as catalysts to speed up the efficiency of a system that is already operating well as a consequence of good design.

GOOD DESIGN FEATURES

To assist movement in the abattoir, a carousel may be used at certain points to simulate a leader sheep. Sheep from the mob can be drafted onto a slowly revolving carousel with the purpose of drawing sheep to this point in the raceway. To be effective, decoy sheep need to be ahead and raised above the level of on-coming sheep so they can be seen by several of the oncoming animals. To aid this, a descending race leading to the chain could be more effective than an ascending raceway.

The importance for cattle of the width of 'people' gates for escape, the height of outside human walkways, the curves involved in the design of good chutes, the design to ensure animals about to enter the knocking box remain placid and other spatial features have been documented in several of Grandin's papers (1980a; 1980c; 1983b; 1987). Good design features for deer and goats are not as easily found in the literature, the designs for some of the less well known exotic species like llamas, camels, buffalo have not been adequately researched or documented.

TROUBLE-SHOOTING IN ABATTOIRS AND MEAT PACKING PLANTS

Many new ideas have been tried in abattoirs over the years, yet often the basics have been overlooked. Floors are a good place to begin. Grating running lengthwise rather than across the movement of visual species sets up a 'visual cliff' effect and balks moving animals. Floors which are poorly supported and bounce as animals move over them restrict free flowing movement. Poor footholds are disruptive to cattle, and drains and ledges halt pig movement. Hock bars which do not cross the whole width of the race, thus allowing sheep to shift their feet back without hitting them look nice but are ineffectual. Broken gate latches or jagged rails, temporary or make-shift repairs can result in animal injury or delays as by-pass routes have to be used. Poorly designed water spray units not only do not shift dirt and

dust on sheep but distress the animals and hamper further movement.

Having to shift men and dogs back in the face of on-coming animals is often a feature of meat works. The flow patterns of essential auxilliaries such as other animals and people have not been considered. Swine do not run well when the early rising sun blinds them as they move. At times I despair at engineering designs, but a basic concern for the animals lead me to make whatever suggestions for change the management are likely to accept. Some change should be better than none at all.

CONCLUDING COMMENTS

Nield (1986) has made a very strong statement regarding the relative importance of human rights or animal rights. He suggests that Scientists, Teachers and those involved in the meat industry, because of their poor thinking, inadequate practice and generally apologetic stance have been caught on the backfoot at times when other lobbyists mount campaigns against experimental surgery, school dissection classes or the handling and slaughter of animals for meat. He contrasts, "...the power of the 'human rights' case, applied to ritual slaughter and the relatively ineffectual reasoning which the scientific community used to justify scientific pursuits involving animals". Not only must the philosophic case of the meat industry be a good one but the whole design and handling phase of stock on the way to slaughter must be beyond reproach. It may not look like an essential area for expenditure and thoughtful design. General cleanliness and more importantly the selection and training of people for stock handling warrants much greater care and attention. Accidents to people can be costly and animal caused accidents in NZ are serious (Kilgour and Houston 1979).

For improvements in animal handling to happen it is essential for people in the management team to have had experience in all practical aspects of the shepherding and slaughter, as well as the dressing and final assessment of the product's quality. A team consisting solely of high powered management can only spell disaster for the meat industry.

If stockpersons are to be trained, animal handling manuals such as that produced by the Accident Compensation Commission in New Zealand (Holmes 1984b) must be more widely used. Several new videos cover animal handling skills. Bonus systems for quality handling is another possibility.

The main focus of those involved in the meat industry has been the carcass and its quality, saleability etc. The likely causes of blemishes which arise as consequences of pre-slaughter events, have been the target of considerable research. The variables are hard to control;

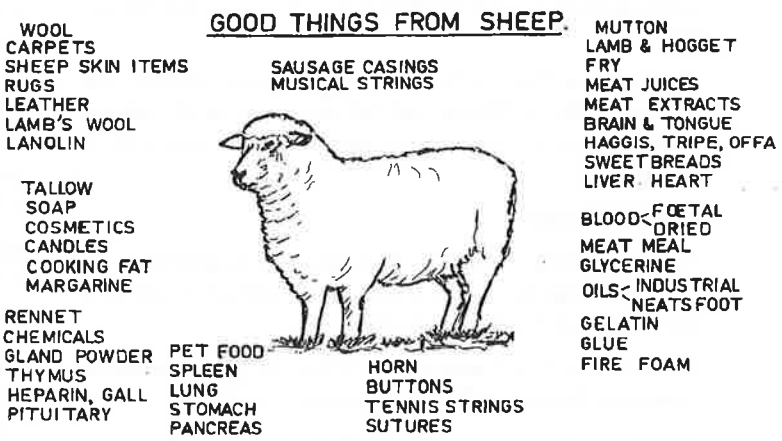

Figure 4. A prototype poster on sheep - part of public education about the range of products from domestic species. Posters such as these must indicate the wide role played by Meat Industry products in everyday living.

the results suggestive. Stresses "somewhere out there" clearly appear to be the root of PSE, or high pH meat. People still keep looking for unique causative factors. It is my contention that no breakthroughs will be made until the attention shifts from the carcass to the living animal coping more or less adequately with the pre-slaughter conditions it faces. In the longer term, the present emphasis on welfare, which is in part decried by the industry, will not be detrimental, but will force us all to become "live animal centred" to the benefit of product quality, handling efficiency and overall profitability.

The public image of the useful functions of farm animals, not just for meats but the other basic items, such as hides, fibres, hormones, organs etc needs better promotion by the Industry as a whole (see Figure 4 for one example). The industry must be more involved in public education.

Finally, some group in the industry should act as a clearing house for the design plans of new Works yards; rated not only for cost effectiveness, but for their humaneness to handled animals; efficiency for human operation; and whether the design is a prototype or has been assessed as functional and valid for each class of stock.

For years many have stated that more attention must be given to the animal handling side of the whole meat slaughter process. I keep wondering when it will be given the serious consideration it deserves

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