

## Human-animal relationships at sheep and cattle abattoirs

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### Abstract

There are accumulating international data in a number of livestock industries that show that a negative attitude by stockpeople towards interacting with pigs, dairy cattle and poultry is correlated with increased levels of fear and stress in farm animals and in turn reduced animal productivity. While most of this research has been on-farm, one study has shown similar attitude-behaviour correlations in a pig abattoir. The major aim of this research was to examine the stockperson attitude-behaviour at sheep and cattle abattoirs. Twenty-two Australian abattoirs participated in the collection of stockperson attitudes and behaviour (81 stockpeople — 35 cattle stockpeople and 46 sheep stockpeople; six abattoirs slaughtering cattle, six slaughtering sheep and ten slaughtering both cattle and sheep). Several significant correlations between stockperson attitudes and behaviour were detected. In particular, the perceived pressures imposed by perceived lack of control over their actions, perceived time constraints, perceived effect of poor facilities and inappropriate beliefs about arousing livestock were all associated with frequent use of forceful handling behaviours by the stockperson. These results were similar to observations in pig abattoirs that have been reported previously. These relationships at cattle and sheep abattoirs indicate that there may be an opportunity to improve stockperson behaviour and consequently reduce stress in sheep and cattle at abattoirs by targeting attitudes (and behaviour) for improvement, with appropriate educational and training material in a way that is similar to the uses of such training with livestock species in farm settings.

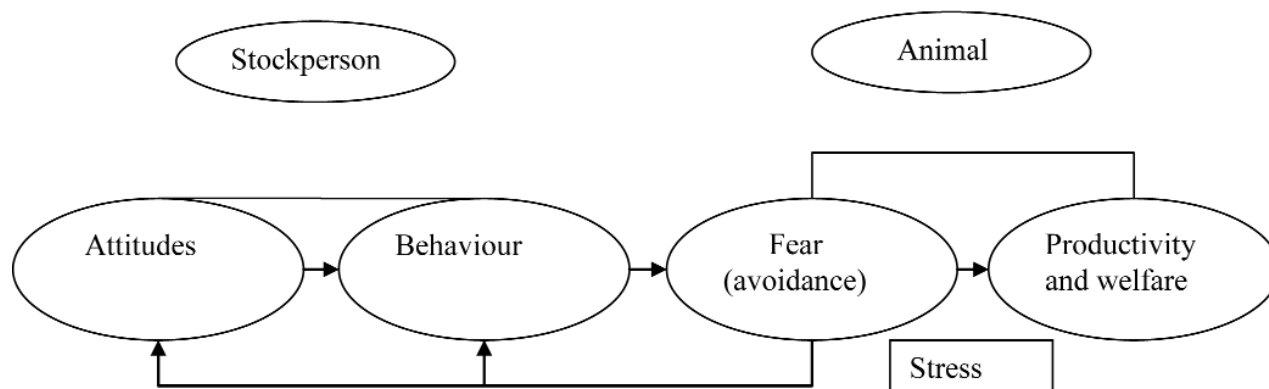
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### Introduction

Handling by stockpersons can cause stress to farm animals in many ways. Some of these handling practices are well known and others are less so. There are accumulating international data in a number of livestock industries (eg Hemsworth *et al* 1989, 2000; Coleman *et al* 1998; Breuer *et al* 2000; Lensink *et al* 2000, 2001; Waiblinger *et al* 2002; Edwards 2009) that show that a negative attitude by stockpeople towards interacting with pigs, dairy cattle and poultry is correlated with relatively high frequencies of negative behaviours by the stockperson, increased levels of fear and stress in farm animals and, in turn, reduced animal productivity. While most of this research has been on-farm, one study (Coleman *et al* 2003) has shown similar attitude-behaviour correlations in a pig abattoir. As a consequence of such research, the sequential model shown in Figure 1 has been proposed by Hemsworth and Coleman (2010) to describe the influence of human-animal interactions on the productivity and welfare of intensively managed farm animals.

In their previous research at a pig abattoir in Australia, Coleman and others (2003) found that stockpersons who felt under pressure to keep up with the rate of the killing chain and those who believed that it is important to move pigs as quickly as possible tended to be less likely to use the electric prod when it was turned off; that is, as a relatively benign aid to move animals, than did those who believed it is not important to move the pigs quickly. The belief that the way in which pigs are handled when waiting to be slaughtered does not affect pig behaviour was associated with high use of the electric prod when it was turned on, ie as a deliberate aversive stimulus to the pigs. Thus, a particular characteristic of the environment in which stockpersons handle livestock in abattoirs may be the feeling of time pressure and this may increase the likelihood of negative attitudes towards handling pigs and the use of negative interactions when attempting to move the animals quickly. However, there is evidence to show that increased fear in pigs can actually increase the time it takes to move them over a standard route (Hemsworth *et al* 1994b).

Figure 1



Sequential relationships between some key stockperson and animal variables (from Hemsworth & Coleman 2010).

Stress prior to slaughter is associated with increases in cortisol and metabolic changes at the level of the post mortem muscle which can affect meat quality (Warner 2007).

Research in the livestock industries (Hemsworth *et al* 1994a, 2002; Coleman *et al* 2000) has shown the potential for training programmes that target relevant attitudes and behaviour of stockpersons to reduce fear of humans and consequently improve the productivity and welfare of animals in farm settings. However, little research has been undertaken on the impact of handling farm animals prior to slaughter on their welfare.

The aims of this research at Australian sheep and cattle abattoirs were to undertake field measurements on both the attitudes and behaviours of stockpersons handling stock prior to slaughter and to examine the relationships between stockperson attitudes and their behaviour towards sheep and cattle. It was hypothesised that negative handling by stockpersons would be correlated with their attitudes towards working with sheep and cattle, particularly their beliefs about perceived time pressure and the need to move livestock quickly. The research reported here on stockperson attitude and behaviour relationships has not been published elsewhere but related research on handling and stress relationships in sheep and cattle abattoirs has been reported elsewhere (Hemsworth *et al* 2011).

## Materials and methods

### Abattoirs, stockpersons and study animals

Twenty-two Australian abattoirs participated in the collection of stockperson attitudes and behaviour (81 stockpersons — 35 cattle stockpersons and 46 sheep stockpersons; six abattoirs slaughtering cattle, six slaughtering sheep and ten slaughtering both cattle and sheep). Stockpersons were observed handling at least 20 sheep or cattle prior to slaughter and were subsequently asked to complete an attitude questionnaire. All research was approved by the

Human Research Ethics Committee at the University of Melbourne, Australia.

### Stockperson behaviour observations

Stockpersons were observed handling sheep and cattle prior to slaughter in two areas in lairage at each abattoir. These two study areas were the forcing pen and the single-file race leading to the stunning area.

Within each of these study areas, stockperson behaviour was recorded during the following discrete activities: moving animals from the forcing pen to the race and moving animals up the race to the restrainer where animals were stunned prior to slaughter.

A team of five trained observers was used to conduct stockperson behaviour observations and one observer was randomly assigned to each abattoir.

The frequency of tactile auditory and visual interactions used by each of the stockpersons under study was recorded. Tactile interactions by stockpersons that were recorded with the variable names used for analysis (in parentheses) were: touching and pushing (Touch/Push), slapping and hitting (Hit) and electric goad use (Goad). Touches and pushes were grouped since it was difficult at times to distinguish between these interactions. Auditory interactions included talking (Talk), whistling (Whistle), shouting (Shout) and use of artificial noises such as shaking metallic rattles and banging on pen fittings (Artificial noise). The only visual interaction by stockpersons that was recorded was waving (Wave). A bout criterion interval of 5 s was chosen to separate one bout of the behaviour from another bout of the same behaviour. From these observations on stockperson behaviour and the number of animals handled, the total numbers of tactile, auditory and visual interactions used per animal handled were calculated for each stockperson studied. Furthermore, the main interactions that made up these three types of interactions used per animal handled were also calculated for each stockperson.

**Table 1** Items (statements) contained in each of the 5 attitude sub-scales identified from a Principal Component Analysis (and their subjective labels).

Attitude subscales	Items
Control	The use of dogs is the most effective method for moving the following animals I decide how quickly the animals move through the forcing area I decide how quickly the animals move up the race I have control over how many times I work on the forcing pen and race A squirt from a pressure hose is an effective tool to move the following animals when stubborn
Flooring	Running stock over wet ground can cause them to be uncertain of their footing Running stock over uneven/changes in flooring can cause them to be uncertain of their footing
Pressure	Time constraints mean that stock handlers do not have time to correctly handle livestock If co-workers are poor at handling livestock it means more work for others There is no relief for stock handlers if they are under time pressure
Facilities	Previous handling on farm or during transport has a big effect on ease of handling at the abattoir Poor facilities make livestock hard to handle
Stimulation	Younger livestock are hardest to handle The use of electric goads with the following animals does not stress them The use of dogs with the following animals does not affect meat quality Stirring up the following animals makes handling easier

### Stockperson attitudinal questionnaire

Using transcripts from focus groups at three abattoirs to obtain information on the relevant attitude domains, an attitude questionnaire was developed which consisted of three sections. The first section consisted of demographic questions regarding the stockperson's age, education, work, history, etc. The second section comprised 44 statements about the stockperson's beliefs about the present job setting that may have implications for animal behaviour, animal handling or animal stress such as 'The rate at which the killing chain moves determines the rate at which I move the animals through the forcing area'. The third section consisted of 25 statements about handling stock and the animals themselves, such as 'The following animals require respect'.

Once all behavioural observations had been completed at all participating abattoirs, the abattoirs were revisited and each consenting stockperson was asked to complete the questionnaire. Each stockperson was advised that, as someone with considerable experience in working with sheep and/or cattle, his or her opinions would be a useful addition to the study observations. The questionnaire was completed in the presence of a researcher in an attempt to limit collaboration between participating stockpersons.

In presenting the questionnaire, stockpersons were asked to indicate whether they agreed or disagreed with each of the statements using a Likert scale which consisted of five options: strongly agree, agree, neither agree nor disagree, disagree and strongly disagree. The responses were scored so that disagreement with a statement scored 5 while agreement scored 1. By using a variety of statements relating to a particular topic, consistent beliefs relating to that topic could be established and the attitude toward that topic inferred (Hemsworth & Coleman 2010). Thus, the beliefs that the stockpersons held in relation to statements about their stock and their work were used to assess their specific attitudes toward their stock and their work.

### Statistical analysis

A Principal Component Analysis was conducted on the attitude data from the questionnaire to reduce the large number of attitude variables to a relatively small number of components, where the components reflect commonalities amongst those individual variables that correlate highly with each other. This analysis identified five components from the data and these were used to characterise the attitudinal profiles of the stockpersons under study. A list of these attitude components and the items contained in each component are presented in Table 1. A subjective labelling of each component based on semantic content of the items is also included in this table. The sums of responses to the items that loaded highly on each component were used to form sub-scales as the dependent variables. These sub-scale scores were used for subsequent statistical analyses.

The independent statistical unit in the analyses was the stockperson. Because stockperson behaviour data were highly positively skewed, the behaviour data were transformed using  $\log_{10}$ . Pearson correlation coefficients (SPSS statistical package SPSS 16.0, SPSS Inc, Chicago, Illinois, USA) were used to examine the associations between the five attitude subscale scores (Table 1) and stockperson behaviour variables: Talk, Whistle, Shout, Artificial noise, Waving, Touch/Push, Hit and Goad. The stockperson attitude and behaviour data are averages across species within stockpersons and, as a result of not all stockpersons being available at the time of data collection, the sample size for the correlation analyses was 43 independent observations (ie stockpersons).

### Results

It was not possible to collect attitude data for all stockpersons who participated in the behavioural observations because of staff turnover and absences at the time of the visits. Furthermore, while most stockpersons who

**Table 2** The main statistics for the observed behaviour of stockpeople towards cattle (n = 35 stockpeople).

Interactions	Mean ( $\pm$ SD)*	Minimum*	Maximum*
Auditory	0.95 ( $\pm$ 1.26)	0.00	6.54
Tactile	0.72 ( $\pm$ 0.70)	0.00	2.76
Visual	0.65 ( $\pm$ 0.80)	0.00	3.87

\* Frequency per animal handled.

**Table 3** The main statistics for the observed behaviour of stockpeople towards sheep (n = 46 stockpeople).

Interactions	Mean ( $\pm$ SD)*	Minimum*	Maximum*
Auditory	0.09 ( $\pm$ 0.10)	0.00	0.57
Tactile	0.45 ( $\pm$ 0.03)	0.00	1.66
Visual	0.03 ( $\pm$ 0.04)	0.00	0.17

\* Frequency per animal handled.

completed the questionnaire answered all questions, a small number failed to complete all questions.

### Stockperson behaviour

The means ( $\pm$  SD) and minimum/maximum values of the main classes of stockperson behaviour studied (auditory visual and tactile interactions) are presented in Tables 2 and 3. These statistics provide a useful description of the typical stockperson behaviour observed at the study abattoirs. In particular, the standard deviations highlight the substantial variation observed between stockpeople in their behaviour towards their animals at the abattoirs.

### Stockperson attitude and stockperson behaviour

The Pearson correlation coefficients between the five attitude sub-scales' scores and the main interactions: Talk, Whistle, Shout, Artificial noise, Waving, Touch/Push, Hit and Goad, are presented in Table 4. The patterns of correlations shown in this table indicate some consistent relationships.

Specifically, the sub-scale Control was often at least moderately negatively correlated with Talk, Shout, Artificial noise and Touch/Push. Many of these correlations were significant ( $P < 0.05$ ) and negative and since a high sub-scale score indicates disagreement with the statements or items, these correlations suggest that stockpersons who believe that they do not have discretion about their actions and do not consider dogs and the use of a pressure hose as effective tools, tend to hit, whistle, and talk more and as well as using more artificial noise than those who do not agree.

In relation to the sub-scale Flooring, the significant ( $P < 0.05$ ) and positive attitude-behaviour correlations indicate that stockpersons who believe that poor flooring makes animals unsure of their footing tend to use a goad less and to talk and whistle less than those who do not agree.

In relation to the sub-scale Pressure, the significant ( $P < 0.05$ ) and negative attitude-behaviour correlations indicate that stockpersons who believe that time constraints make it less easy to handle livestock properly tend to use more hits and whistles when moving animals than those who do not agree.

Stockpersons who believe that external factors make livestock hard to handle (Facilities sub-scale) tend to whistle more ( $P < 0.05$ ), while those who believe that it is appropriate to arouse livestock by various means and that use of goads is not stressful (Stimulation sub-scale), tend to use the goad more, talk more but wave less.

Since these data were collected at a number of abattoirs, stockpersons are nested within abattoirs. Thus, the observed correlations may, in part, be due to differences between abattoirs. When abattoir effects are partialled out, the degrees of freedom for correlations reduce to 20. This is because, typically, only between one and three stockpersons came from any individual abattoir. Nevertheless, to provide a further indication of the patterns of relationships between attitudes and behaviour, the correlations between stockperson attitudes and behaviour with abattoir partialled out are reported in Table 5.

In general, the patterns of correlations are similar in magnitude to those in Table 4 but have reduced significance levels because of the reduced degrees of freedom. The partial correlations between goad use and attitudes show a broadly similar pattern to the raw correlations, although not many are significant because of the low degrees of freedom. In the case of talking, shouting, waving hits and goad use, the patterns are broadly similar for both analyses. For whistling, the correlations that had been observed between Flooring and Pressure sub-scales disappear in the partial correlation analysis. In the case of use of artificial noises, the main difference between the results of the two analyses is a significant partial correlation between artificial noises and Flooring subscale, indicating that stockpersons who do not agree that poor flooring makes animals unsure of their footing tend to use more artificial noise than those who agree. Further, in the case of touches and pushes, the partial correlations indicate that those who do not agree that poor flooring makes animals unsure of their footing or who do not agree that time constraints make it less easy to handle livestock properly tend to use more touches and pushes when moving livestock. The partial correlation between goad use and Control sub-scale is substantially higher than that for the raw correlations.

### Discussion

Recent research by the authors found significant relationships between handling of sheep and cattle prior to slaughter at commercial abattoirs and cortisol concentrations in these sheep and cattle post slaughter (Hemsworth *et al* 2011). The major aim of the present research was to examine the attitude-behaviour relationships of stockpersons handling sheep and cattle prior to slaughter. An under-

**Table 4** Pearson correlation coefficients between stockperson attitudes and log stockperson behavior scores (frequency of behaviour per animal handled; sample size is 43 stockpersons). High attitude scores indicate disagreement with the statements (see Table 1). Negative correlations imply that stockpersons who agree with attitude statements show low levels of the relevant behaviour.

Attitude sub-scale	Stockperson behaviour							
	Talk	Whistle	Shout	Artificial noise	Waving	Touch/ Push	Hit	Goad
Control	-0.32**	-0.31**	-0.03	-0.20*	-0.04	-0.08	-0.21*	-0.14
Flooring	0.51**	0.06	0.58**	0.14	-0.17	0.03	0.01	0.36**
Pressure	0.06	-0.30**	0.11	-0.08	0.01	0.08	-0.28**	0.14
Facilities	-0.17	-0.30**	-0.02	-0.10	0.11	-0.13	0.05	-0.13
Stimulation	-0.20*	-0.06	-0.19	0.16	0.41**	-0.11	-0.02	-0.30**

\*\* Correlation is significant at  $P < 0.01$  level; \* Correlation is significant at  $P < 0.05$  level.

**Table 5** Pearson correlation coefficients with abattoir partialled out between stockperson attitudes and log stockperson behaviour scores (frequency of behaviour per animal handled) (degrees of freedom for the partial correlations is 20). High attitude scores indicate disagreement with the statements (see Table 1). Negative correlations imply that stockpersons who agree with attitude statements show low levels of the relevant behaviour.

Attitude sub-scale	Stockperson behaviour							
	Talk	Whistle	Shout	Artificial noise	Waving	Touch/ Push	Hit	Goad
Control	-0.32	-0.32	-0.04	-0.30	-0.32	0.13	-0.40	-0.43*
Flooring	0.28	0.17	0.26	0.52*	0.17	0.43*	-0.17	0.34
Pressure	-0.21	0.01	-0.22	0.00	0.01	0.55**	-0.35	-0.03
Facilities	-0.22	-0.06	-0.07	-0.06	-0.06	0.29	-0.03	-0.18
Stimulation	-0.32	-0.09	-0.10	-0.23	-0.09	0.18	0.18	-0.27

\* Correlation is significant at  $P < 0.05$  level; \*\* Correlation is significant at  $P < 0.01$  level.

standing of these relationships may provide the opportunity to reduce animal stress during handling by identifying the attitudes that predict those handling behaviours that lead to stress in these animals.

As seen in previous research on farm animals in commercial farm settings (Hemsworth *et al* 1989, 2000; Coleman *et al* 1998; Breuer *et al* 2000; Lensink *et al* 2000, 2001; Waiblinger *et al* 2002; Edwards 2009), there were some consistent patterns of correlations between the attitude subscales that were identified in this study and several stockperson behaviours. These patterns of correlation may be explained in the following way.

Because the items in the Control sub-scale related to moving animals quickly, it may be that the speed of the chain and the behaviour of the stock may make stockpeople feel they have less control over what they do or what they would like to do. This may lead to pushing animals harder using frequent shouting, whistling, artificial noise and hits. Stockpersons who agree that uneven flooring makes animals uncertain of their footing may be more aware that

the immediate surroundings affect their animals and therefore may not tend to push them quite so hard. The stockpersons who agree that time pressure does not allow them and others to properly handle animals appear more likely to push the animals harder than those who disagree. Finally, stockpersons who believe that goads and dogs are appropriate methods to move animals and who believe that it is best to keep the animals moving and that the use of goads does not stress them, may use goads more because they believe it does not impact on the animal's welfare.

Further, as mentioned previously, data from recent related research (Hemsworth *et al* 2011) indicate that a number of stockperson behaviour variables predict plasma cortisol concentrations post slaughter in sheep and cattle. For example, the stockperson behaviours that were associated with increased cortisol were increased dog use, fewer touches and pushes and fewer whistles for sheep and increased electric prods for cattle. Clearly, the findings from these two studies indicate that a better understanding of these attitude-behaviour-stress relationships will lead to a

better appreciation of the important stockperson attitudes and behaviours that may impact upon animal stress in sheep and cattle at abattoirs.

Overall, these results increase our understanding of the factors that may underlie the behaviour of stockpeople in abattoirs beyond that obtained in our earlier study (Coleman *et al* 2003). In that study, only two target behaviours by stockpersons were used, that is, the use of an electric goad while turned off and the use of the electric goad while turned on. In this present study, a much wider range of stockperson behaviours were recorded. Further, in the earlier study, the only behaviourally relevant attitudes that were measured were beliefs regarding the need to move pigs quickly and beliefs about the effects that stockperson handling had on their pigs. In this study, beliefs about time pressures were included but so were a range of other behaviourally relevant beliefs that have already been described. These results permit any training programmes that may be developed from this research to target a wider range of behaviours and a wider range of underlying attitudes than was the case for pig abattoirs. These differences between the earlier study and the current research also indicate that there is a specificity of attitudes and behaviours that may depend on the species under study and the context in which the animals are handled. This point is clearly illustrated in the fact that while a generic attitude-behaviour model applies across all of the livestock industries studied, there are specific issues that are relevant to particular species and contexts (Hemsworth & Coleman 2010).

In conclusion, these attitude-behaviour-stress response relationships at cattle and sheep abattoirs indicate the opportunity to improve stockperson behaviour at Australian abattoirs by targeting attitudes (and behaviour) for improvement with appropriate educational and training material in a way that is similar to the uses of such training with other livestock species in farm settings. The current results do not permit causal inferences to be made but if training programmes did improve stockperson attitudes and behaviour as well as the stress response of the animal, then causality would be demonstrated. Such training programmes in farm settings have been specifically designed to target those attitudes and behaviours of the stockperson which had a direct effect on animal fear and productivity. The training package for the pig industry is called 'ProHand'® ('Professional Handling of Pigs Program') and this approach has been extended into a package for dairy stockpersons and, following recent research at abattoirs, into a package for pig abattoir stockpersons in Australia (Hemsworth & Coleman 2010). Training packages based on the ProHand principles have been developed by the authors and colleagues in Austria, France and The Netherlands for pig, dairy, cattle, beef cattle and laying hen stockpersons under the label, 'Welfare Quality'®.

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