Snapshot report

AMPC
AUSTRALIAN MEAT PROCESSOR CORPORATION

Jarvis ‘Stealth Box’ Validation

Evaluation of the new Jarvis ‘Stealth Box’ in improving animal movement into restraint

Project code
2022-1149

Prepared by
Alison Small, Hamideh Keshavarzi, Adam Fitzgerald and James Bishop

Date submitted
31/10/2024

Project description

Improving animal welfare in abattoirs is crucial, particularly with increasing public concern about meat production. A key stage in the process is handling of animals from lairage pens, along the lead in race to the knocking box. The movement of livestock and subsequently stress reduction at abattoirs can be improved by using new and less noisy operational systems. Jarvis Australia have developed a restraint unit incorporating a variety of noise-reduction strategies (e.g., silencer manifolds on actuators and valve exhausts; nylon lining inside the box and on the roll out cradle; rubber matting on the floor). Known as the ‘Stealth Box’, the unit is also fitted with the latest models of the Jarvis pneumatic and electrical stunning systems, which include stun monitoring processes as well as the ability to control stun input variables.

The aim of the project was to (1) validate the new Jarvis ‘Stealth Box’ in improving animal movement into restraint, in terms of animal behaviour, meat quality and acoustic measurements; and (2) evaluate the feasibility of automating monitoring of animal handling through identification of acoustic signatures of specific sounds from audio recordings.

Project content

Video and audio recordings were collected at eight beef processing plants and annotated offline. Pre- and post-installation data were available for four plants, while post-installation data was available for all eight. Pre- and post-installation pH declines were obtained from three processors, while samples of striploin and eye round were collected pre- and post- installation from one processor and analysed for objective meat quality parameters (shear force, water holding capacity, colour and lipid oxidation).

Project outcome

For animal handling and behaviour, two separate analyses were conducted: one to compare pre- and post-installation data to evaluate the impact of the ‘Stealth Box’, and another using only post-installation data to compare the processors in terms of operational performance using the ‘Stealth Box’. Individual scores for behavioural and handling (aid and noise) interventions were measured to detect the cattle welfare.

Overall, there was a noticeable reduction in almost all parameters, with the exceptions of 'Back up' and 'Rush' (Figure 1). Statistical analysis confirmed that cattle were 1.74 times less likely to receive a handling aid post-installation compared to pre-installation (60% vs. 80%, respectively; $P < 0.01$). However, there was no reduction in handler noise, which might suggest that using the ‘Stealth Box’ shifted animal handling from physical methods to less stressful options such as whistling.

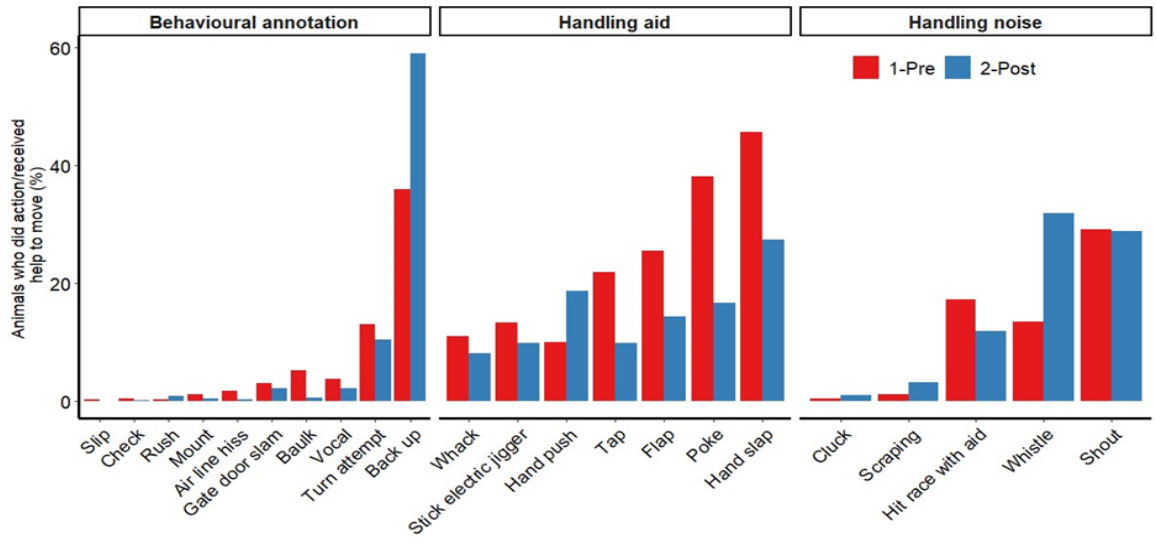

Figure 1: Differences in each observed parameter pre- and post-installation of the 'Stealth Box' (all processors combined).

The post-installation analysis showed that handling interventions varied significantly among processors ($P < 0.05$; Figure 2) indicating the operational effects on animal behaviour and welfare in abattoirs.

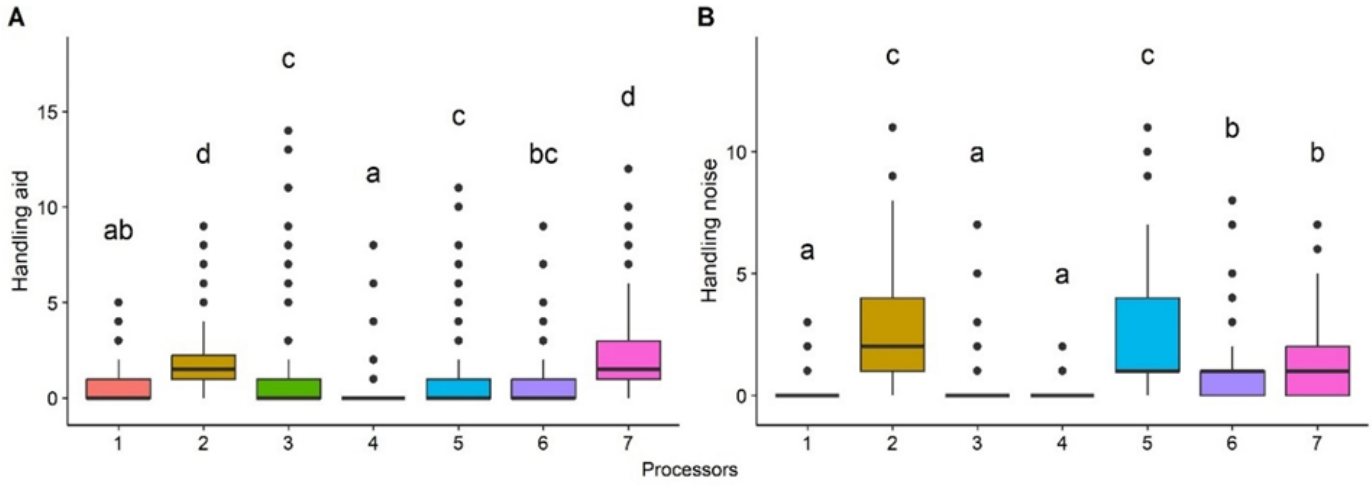

Figure 2: Results of post-installation analysis for A) Handling aid, and B) Handling noise across seven studied processors. Note: Processors sharing the same lowercase letters are not significantly different ($P > 0.05$).

For meat quality and pH declines, the results indicated that there might be a slight improvement post 'Stealth Box' installation, but the sample size was small and the outcomes would have been strongly influenced by animal and processing factors.

From the acoustic analysis, it is highly likely that the acoustic environment has changed in the knock box and lead in race (Figure 3), indicating that there have been changes to animal and/or personnel behaviour.

Force Pen			
Processor	Events / Min	Mean Duration	Total Duration
1	Increase	Decrease	Increase
2	Increase	Decrease	Decrease
3	Increase	Decrease	Increase
4	Decrease	Increase	Decrease

Lead In			
Processor	Events / Min	Mean Duration	Total Duration
1	Increase	Increase	Increase
2	Increase	Decrease	Decrease
3	Decrease	Increase	Increase
4	Decrease	Increase	Decrease

Knock Box			
Processor	Events / Min	Mean Duration	Total Duration
1	Increase	Decrease	Increase
2	Decrease	Increase	Decrease
3	Increase	Decrease	Increase
4	Decrease	Increase	Decrease

Roll Out			
Processor	Events / Min	Mean Duration	Total Duration
1	Decrease	Increase	Increase
2	Increase	Decrease	Increase
3	Increase	Decrease	Decrease
4	Decrease	Decrease	Decrease

Legend	
Minimal	0 - 9.9%
Notable	10 - 29.9%
Significant	>30%

Figure 3: A summary of the changes to sound event metrics across each of the 4 processing sites with acoustic data before and after 'Stealth Box' installation. Results have been colour-coded to denote their significance.

In terms of automating monitoring via acoustic recording, there is a high level of variability between animals within processing groups, and between groups. Individual animals display different responses to stimuli experienced within the processing environment and may require differing levels of staff handling. Groups of animals arrive at the processing site from disparate locations, and their behaviour is largely based on their temperament and previous experiences, such as the level of human contact and handling they have been exposed to. These groups may require a higher level of staff intervention to successfully navigate the processing system. Staff members have individual preferences pertaining to animal handling and intervention. For example, some staff may whistle to keep animals moving, while others may use calls. These differences in staff behaviour will produce dissimilar acoustic environments as the types of sound events will change. Staff members can change over time, adding further variability to long-term data collection. There are numerous external factors that can also affect the acoustic environment, such as weather, seasonal conditions, and natural phenomena. Future studies should aim to collect more contiguous data over a longer period, to reduce the effect of variability on acoustic analysis. By gathering data from a wider range of processing sessions, a more accurate representation of the acoustic environment can be obtained.

Benefit for industry

Based on the results obtained from the behavioural analysis, we conclude that, while the 'Stealth Box' has improved animal movement into the race, variations between processors indicate that other components of each system may need to be replaced or reviewed to achieve further improvements in animal welfare. Meat quality and pH decline data indicate that beneficial effects may be present, but these are confounded by animal differences and other electrical inputs during processing. The processors who provided pH decline data were using percussive stunning – if electrical stunning were implemented, this would increase the electrical inputs to the carcase and increase the rate of pH decline.

An AI-based system capable of detecting and interpreting sounds of interest that may occur in a processing site is most certainly feasible, but significant research is required.