



Virtual herding NEWSLETTER

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Virtual herding research update

‘Enhancing the profitability and productivity of livestock farming through virtual herding technology’ is a four-year project to evaluate the application of virtual herding (VH) technology across different production systems and examine the responses of different livestock (dairy cattle, beef cattle, sheep) to various cues and stimuli to improve productivity and profitability in the livestock industries.

The Project

The project received \$2.6 million from the Australian Government through its Rural R&D for Profit program. A further \$1.365 million has been provided by a number of Rural Research and Development Corporations and R&D providers. The R&D providers include, CSIRO, the University of Sydney, University of New England, the Tasmanian Institute of Agriculture, University of Melbourne and Agersens Pty Ltd, with additional contributions from Dairy Australia, Meat and Livestock Australia, Australian Wool Innovation and Australian Pork Limited.

The project aims to evaluate the on-farm application of virtual herding (VH) technology; demonstrate its implementation; and, quantify and extend its benefits across Australia’s major livestock industries.

The Research Team

Using VH, the research team will investigate the potential to constrain animals to certain areas (better grazing management and environmental outcomes), autonomously herd animals, or move individual or groups of animals in a herd differently to the rest of that herd. Fundamental research involving behavioural observations and physiological measurements will be critical to ensure that the technology does not compromise animal welfare.

Introducing Project Team Members – Dr Megan Verdon

Dr Megan Verdon likes to think that she didn’t find her calling as an animal researcher, but rather that, it found her. Megan has a Bachelor of Science with a major in Chemistry, and was working as a chemist in an industrial paint

factory when she decided to go back to University and study something she was always passionate about – the welfare and behaviour of animals.

After completing a post-graduate diploma in animal science and management at the Animal Welfare Science Centre at The University of Melbourne, she commenced her PhD in 2011 and examined individual variation in the aggressive behaviour of group-housed sows, and its implications for sow welfare. Megan developed a predictive test of aggression in sows during her PhD, and used this test to examine the relationships between group composition and social behaviour in the sow.

This project is supported by funding from the Australian Government Department of Agriculture and Water Resources as part of its Rural R&D for Profit program. For information about this project contact Cathy Phelps at Dairy Australia on 0439 555 001 or cphelps@dairyaustralia.com.au or Dr Ray King, Project Manager on 0412 322 047 or r.h.king@bigpond.net.au.



CSIRO and UNE technical staff attaching the virtual herding manual collars to sheep near Armidale, NSW.

Dr. Sabrina Lomax from University of Sydney inspecting some beef cattle as candidates for future research in virtual herding.

In 2014, Megan received the Australian Government (DAFF) Science and Innovation Award for young people in Agriculture and used the funding associated with this award to examine the effects of socialisation on the development of aggressive behaviour in pigs. Megan continued at the University of Melbourne in 2015 to undertake postdoctoral research on the behaviour and welfare implications of multi-suckle group lactation housing systems.

In 2017, Megan joined the Dairy Centre at the Tasmanian Institute of Agriculture (University of Tasmania) as a research fellow in the Virtual Herding project. In this role, Megan is working to understand how virtual fencing technology can be best applied to precision grazing management systems to improve pasture utilisation in dairy cows. Megan believes that the true benefits of virtual fencing technology for the dairy industry will only be realised through an understanding of the fundamental behaviours that encompass grazing and rearing of dairy cattle.

Update on Animal Studies

Sub-Program 3: Determine best sub-herd and individual animal management for dairy and beef

Dr. Sabrina Lomax and Dr. Cameron Clark from the University of Sydney have recently completed the first series of experiments that investigated the variation between cattle in their individual response to virtual herding cues. These experiments involved 24 dry dairy cows and 12 heifers from the University of Sydney herd at Camden, NSW.

Using a simple laneway design, the response of individual animals to audio and electrical stimuli cues delivered through manual virtual fence (VF) collars were recorded over six tests. These customised manual VF collars mimicked the Agersens prototypes that had been used in beef cattle experiments at CSIRO, Armidale. Cows were fed a maintenance ration during the experiment. For testing, cows were trained to access a pellet feed reward in a trough at the end of a 50m laneway. A VF line was set at 25m before the feed trough.

When an individual reached the VF line, she received an audio tone for approximately two seconds. If she continued forward, she received a small electrical stimulus. If she stopped or turned around, the cues stopped. Measurements included the number of audio cues and electrical stimuli received, as well as whether an individual reached the feed reward or not, together with the time taken to do so.

Preliminary results included an interaction between the personality traits of the cattle and their response to virtual fence cues. There was a trend for the more fearful, dominant animals to respond more directly to the audio cues than the more curious, leader animals. In addition, three distinct response types to the VF cues have been identified that are consistent between the cow and heifer groups:

- › Tolerate – the cow has a nil to mild response to the audio or electric stimuli – walking through cues with some mild head turning to reach feed reward
- › Minimise – the cow has a strong response to the audio or electric stimuli – running at audio and/or electric stimuli to minimise the time to reach the feed



Dr Megan Verdon from University of Tasmania getting to know her dairy cows

- › Avoid – the cow has a strong response to audio or electric stimuli – these cows will stop and/ or turn away from feed reward after receiving the VF cues and walk back down laneway away from the VF line.

The results of this experiment suggest that hunger is a strong motivation for breaking through the VF line. Therefore a simple training protocol may be necessary to ensure that the learning and required response is more uniform in a group setting. This will form the next program of work. Future studies will also investigate the ability to virtually herd individuals or sub-groups of animals away from the rest of the herd – with and without a feed reward. This has implications for use in controlling cow traffic in AMS and conventional milking systems. Sabrina will be presenting the results of her research at the upcoming European Conference on Precision Livestock Farming in Nantes, France and at the 7th International Conference on the Assessment of Animal Welfare at the Farm and Group Level in Wageningen, Netherlands in early September 2017.

Sub-Program 4: Using virtual herding technology to better manage sheep

Drs Danila Marini and Fran Cowley from the University of New England have been working with Sue Belson and the technical team from CSIRO over recent months to train sheep to respond to a virtual fence. The first study identified the minimum adequate stimulus that would prevent sheep from entering an exclusion zone, as well as refined the training method for sheep, based on associative learning. The results of this study were recently presented by Danila at the International Society for Applied Ethology in Denmark.

Similar to the cattle studies conducted by CSIRO, the sheep experiments attempted to keep individual animals away from a feed source in the middle of a small paddock. To determine an appropriate stimulus level, 30 sheep were trained to approach a trough containing feed pellets. Once trained, sheep received an electrical stimulus when they entered a three metre exclusion zone around the trough.

A similar method was used for the associative learning test. However this time, an audio cue was given to the sheep for one second when the sheep approached the feed trough. If the sheep did not alter their behaviour (such as turn away) during the audio cue they were immediately given the small electrical pulse. Like the cattle, sheep were quick to learn to turn away from the virtual fence.

On average, it took only three interactions with the fence for the sheep to associate the audio cue with the electrical stimulus and subsequently respond to the audio cue only.

A follow up experiment looked at excluding sheep not previously trained to a virtual fence from one half of a paddock. The results showed that the virtual fence was effective at keeping sheep from accessing the exclusion zone. Interactions with the fence varied between individual animals, but by the third day all sheep were able to respond to the audio cue alone in order to avoid the virtual fence. Future experiments will assess the welfare status of sheep when interacting with the virtual fence.

Latest News:

- › The first of a series of Project webinars was held on 29th June, 2017. The main target for these webinars are members of the Farmer Panel, a group of 25–30 livestock producers who have agreed to learn more about the virtual herding technology and explore possible applications of this technology for the respective livestock industries. A second webinar is planned for 21st September, 2017.
- › Ms Nikki Reichelt was appointed to the Project in June, 2017 as the new Research Fellow at The University of Melbourne and will lead Subprogram 5 to identify considerations and challenges for integration and adoption of virtual herding (VH). Nikki has begun to work with members of the Farmer Panel and Project Team to establish focus group workshops in October, 2017 to identify the challenges and opportunities to adopt and integrate VH technology in a commercial farm context.
- › Agersens have conducted several field studies to test their VH prototypes and expect to produce a limited number of devices for field evaluation with selected beef producers in northern Australia, later this year.
- › A graduate from the University of New England, Ms Tellisa Kearton, has been recruited to the VH project and will begin her studies towards a PhD in September, 2017 after she completes her Masters studies.
- › The Third Milestone Report for the project was submitted to the Department of Agriculture and Water Resources in August.

Further Information

Visit the [Virtual Herding Program](#) online at Dairy Australia.

The site contains information about project activities and recent news about the Project, including copies of a number of presentations that members of the Project Team have made to industry over the past few months.

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