Leadership and Social Facilitation of a Virtual Fence in Beef Cattle

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Automated virtual fencing (VF) is a new agricultural technology where animals are restricted in a specified area via receiving stimulatory cues rather than through the presence of a physical fence (Campbell et al., 2018). Cattle rapidly learn to stay within the specified inclusion zone (IZ) and to respond appropriately to the audio cue alone, thus avoiding receiving the electrical stimuli (Campbell et al., 2019a,b). However, individual cattle within the groups vary greatly in their learning and frequency of interactions with the VF and this may be a result of social influence. Campbell et al., (2019a,b) found that animals exposed to a VF for the first time learned to stay within the IZ and respond to the audio cue alone, however, some cattle turned away from the audio cue without having first experienced the electrical stimulus suggesting social facilitation was occurring. This study aimed to determine social facilitation of response to VF over a three-day period.

Thirty-two Angus steers were placed into four paddocks (8 animals/paddock), divided into two areas- an inclusion and exclusion zone (EZ) via a VF boundary. The animals received the audio cue if they approached the VF followed by an electrical pulse (only) if they continued into the EZ. The GPS data and administered audio and electrical stimuli data were recorded by the neckband device. For analysis of social facilitation score and leadership, individual VF interactions were grouped into 'events' which were defined as starting when the first animal -the leader - contacted the VF and received a signal. The analysis of GPS movement patterns within the paddock identified a total of 82 events. The responses of other animals in the group were assessed for up to 13 mins to categorize if they 1) followed the leader to move into the EZ (followers, F), 2) accompanied him back into the IZ (facilitated, Fa), 3) did not show any reaction (non-facilitated, NFa). Social facilitation score (SFaS) was then calculated as SFaS (%) = (Fa/(Fa+NFa+F)) * 100.

Results showed that a single animal leader led on average 40% of events, two leaders covered 62.7%, and three leaders covered 77% of events (Table 1). Within the 82 events (without considering the first interaction with the VF), 77.4% of total reactions were categorized as social facilitation score which varied from 74.8% in group 4 to 80.5% in group 3 (Table 1).Group 3 broke through the virtual fence in the first night of experiment, and this resulted in differing results compared with the other groups for total events and leadership score.

Study groups	Events led by individual animals (%)[2]			Total	Social facilitation score (%)[1]			Mean
	One leader	Two leaders	Three leaders	events	Day 1	Day 2	Day 3	(SL)
Group 1	27.8	52.8	69.4	36	69.9	77.4	88.7	78.6
Group 2	31.2	50.0	68.7	16	91.2	57.0	79.4	75.9
Group 3	71.4	100.0	100.0	7	100.0	70.0	71.4	80.5
Group 4	29.6	48.1	69.9	27	73.4	68.1	82.9	74.8
Mean/Total	40.0	62.7	77.0	86	83.6	68.1	83.4	77.4

1 . The leader animals are the individuals who touched the fence first for each particular event across three study days.
2. The first event was not considered for calculating the social learning.

Table 1. The percentage of virtual fence interaction events led by leader animal (s) and social facilitation score (SFaS) percentage of animals across three study days.

Overall, our findings indicated that social facilitation supports cattle to respond appropriately to stay within the boundary. For the first VF contact, when animals had no previous experience, all animals near the leader followed the leader into the EZ. Comparatively, when the animals had previous experience with the VF, when the leader reacted to the received signals, the animals near him, even those without any VF experience moved back into the IZ. In relation to the leader animals, it was clear that within the groups, there were three distinct leaders that interacted with the VF more often than others. However, other animals within the group still lead interactions approximately 23% of the time. In conclusion, cattle learned to stay within the virtual boundary based on the response of other animals indicating that social facilitation of responses to the VF stimuli were occurring. Further studies to determine the specific aspects involved in social facilitation and learning of the VF are needed.

References

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