A New Look at Cow Comfort - Studying Cow Behavior with Time-lapse Video

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Watched but Not Seen

"I have watched thousands of cows - getting up, lying down, or feeding at a bunk - yet never seen what those cows really do." That's what many people say after viewing video time-lapse recordings (VTR). VTR reveal the effects that our choices of barn, husbandry system or management have on our cows and our barter of feeding, housing, safety and comfort in exchange for milk.

VTR allow us to critically assess current practices and dogma, increase awareness and knowledge, change attitude and opinion, assess compromises, and enable change. Savvy cattle care professionals are adopting housing and management practices to reduce environmental risks and improve cattle health and dignity. These innovators often respond to doubters with "I used to believe that too, but I don't anymore." Choices in new husbandry systems provide benefits from better cow health and performance, cow behaviour and dignity, the use of less drugs to chase bugs, and a contribution to consumer confidence and milk's image. For some, their choices have put the fun back into going to the barn and helped them hire and retain workers. This video presentation shows what cows do in our barns and the use of VTR for consultation, diagnosis, and outreach programs to dairy producers.

Normal Resting Positions

In Ontario, confinement housing is the norm on most dairy farms for several months of the year and the entire year on many farms. Because of confinement housing, we may have lost touch with *normal* cow behaviour. Common behaviour may not be normal and common housing may not be best for our cows.

The video opens with cows on pasture - cows resting in the wide, narrow, short and long resting positions described by Kammer in 1982. To allow for normal resting positions, the resting area must provide cows with six freedoms:

1. the freedom to stretch their front legs forward,
2. the freedom to lie on their sides, with unobstructed space for their neck and head,
3. the freedom to rest their heads against their sides without hindrance from a partition,
4. the freedom to rest with their legs, udders and tails on the platform,
5. the freedom to stand or lie without fear or pain from neck rails, partitions, or supports, and
6. the freedom to rest on a clean, dry, and soft bed.

To rise or lie down, the resting area also must provide cows with freedom of vertical, forward and lateral movement without obstruction, injury or fear. For a comparison, the video takes viewers inside the barn where we see cows auditing the facility by showing signs of pleasure or displeasure. Several examples of behaviour described in the next section appear in the VTR.

Safety, Behaviour, and Health

Our contract with the cows includes responsibility for safety - freedom from danger, risk or injury. A careful inspection of our cows for injuries to hocks, stifles and knees, or bumps or bruises over the top line or rib cage will reveal how well we are living up to this part of our contract. Their reluctance to use stalls, to move quickly in or out of the parlor or their actions at feed bunks or waterers may also alert us to issues of safety.

Cows in unsafe facilities exhibit fear - feelings of alarm or disquiet caused by the expectation of danger, pain, or disaster. The signs of apprehension include abnormal, unexpected or unwanted behaviour documented in several of the references in the reading list and shown in the video. For example, intention behaviour, or *hesitation waltz,* can last for several minutes before a cow lies in an uncomfortable stall. Intention time should be considered one of several surrogate measures of stall comfort. Stereotypic behaviour, such as head pressing, is another.

Cows show avoidance behaviour from experiencing pain or discomfort while using a facility. On some farms, cows that receive treatments or injections while in the parlor show their apprehension about entering by urination or defecation. Injuries sustained in milk parlors make cows apprehensive about entering and thus slow the milking time. Although electric cow trainers alter behaviour and aid in keeping cows clean, they are also a risk factor for silent heat, clinical mastitis, ketosis and culling relative to cows in herds not using cow-trainers (Oltenacu, 1998). Short tiechains prevent cows from lying in the short resting position. They also restrict cows from exhibiting normal estrus behaviour and thus contribute to “silent” heats and challenges for heat detection. With some stall designs, cows prefer to stand rather than experience the pain associated with lying or rising. Cows cluster around the wet areas of waterers to take advantage of evaporative cooling. They refuse to use stalls bathed in sunlight or warmer sections of the barn, and instead, choose to rest in shaded stalls first or stand in clusters in shaded areas (Overton, 2000). Cows will cluster near open doors and avoid areas with compromised air quality.

Cows may show apprehension from dominance behaviour or intrusion on their comfort zone. Rather than risk injury, subordinates move away from drinking or eating when approached by a dominant cow. In tiestall barns, dominant cows often prevent submissive first-calf heifers from drinking at their shared water bowl. In some freestall barns, cows step into the end stall and drink over a concrete partition rather than stand facing the water trough. Often, cows just drink from the ends of water troughs placed in 8-foot walkways, leading some producers to conclude that they should have saved money and only bought the ends. For a comparison, store designers try to prevent “refusals to buy” by giving shoppers ample “butt space” so we are undisturbed by store traffic. Some dairy producers know this. Their barns have 12-foot walkways where the water troughs are located and they place them on the outside of the traffic curve.

Apprehension may arise from the design of equipment or facilities that is beyond the ability of the cow to cope comfortably. In some barns, we see cows lying partially in the stall and partially in the alley, rising like horses, backing into stalls, choosing the alley to lie, or pawing bedding out of stalls. In tie-stall barns, we see frustrated cows lapping at water or chewing on water bowls because the stabling and bowl position prevent them from getting their head in to drink comfortably. Feed tossing is more common when cows must eat from elevated feed

bunks. The “water-flinging” behaviour seen when cows must drink from four-foot high water troughs could be similar to the feed-tossing behaviour at high feed bunks. Sometimes, in barns with slippery floors or those with short tiechains and electric trainers, cows protest silently, by not showing signs of estrus.

Design or construction features of the facility, or characteristics of the husbandry system, can lead to diseases in cattle that are not associated with fear. Examples are traumatic injuries, sore feet, mastitis, or metabolic diseases. Sore feet (laminitis, sole ulcers, strawberry foot rot, or heel horn erosion) often have predisposing causes related to housing, environment, husbandry or behaviour (Philipot, 1994; Leonard, 1996) (Galindo, 2000). In some stall designs, cows also may spend considerably more time lying on hard surfaces without rising to change positions. This behaviour poses another challenge to interpretation of stall use and lying time.

Our quest for clean stalls, clean cows and reduced labor leads to positioning a neck rail, a brisket board and loops to locate the cow towards the alley curb and to keep her relatively straight in the stall. Cows stand sideways to get more unobstructed room when the neck rail is too low and too close to the rear of the stall. They also stand sideways when they have short side-lunging stalls. It follows that cows in these stalls lie sideways and when they defecate, the manure is on the stall corners. Some fix this problem by narrowing stalls, forcing cows to lie straight so they defecate in the alley. However, cows on pasture (normal, unobstructed) will end up lying slightly angled from their original standing position. Although this “narrow-stall-fix” keeps stalls clean, it creates more problems because cows cannot keep their tails or legs on the platform and they are restless in the narrow and short stalls. Their tails become dirty from resting in the walkways. Their feet also become soiled while dropping off the platform and these soiled feet drag manure back onto their bed. The latter is often viewed as an increased risk of environmental mastitis.

Some have chosen to treat these signs of sick barns (dirty tails, dirty stalls) by amputating tails or building narrower stalls. On the other hand, producers leading the way in cow ergonomics and rest are choosing to build open front freestalls, raising and repositioning the neckrails, making stalls wider, and changing the position and style of brisket restraint. For similar cow comfort concerns in tiestall barns, producers are building stalls with longer and wider platforms, tierails higher above the bed and forward of the manger curb, open-front stalls, and installing longer tiechains. These changes to tiestall barns virtually eliminate “stupid heifer syndrome” and the difficulties of rising experienced by some older cows.

Cow Ergonomics

Cow ergonomics concerns the improvement of cow health and performance through the careful design of her work environment. Ergonomic innovations in dairy barn design and construction aim to increase the health, safety and longevity of our cows. To build ergonomically correct stalls, we need to recognize normal resting positions, normal rising motions and normal lying motions. We also need to know cow size and their space requirements for these normal behaviours. In the United Kingdom, W.B. Faull and J.W. Hughes observed cows freely lying and rising in a field to establish the space requirements for Friesian-Holstein cattle (Table 1).

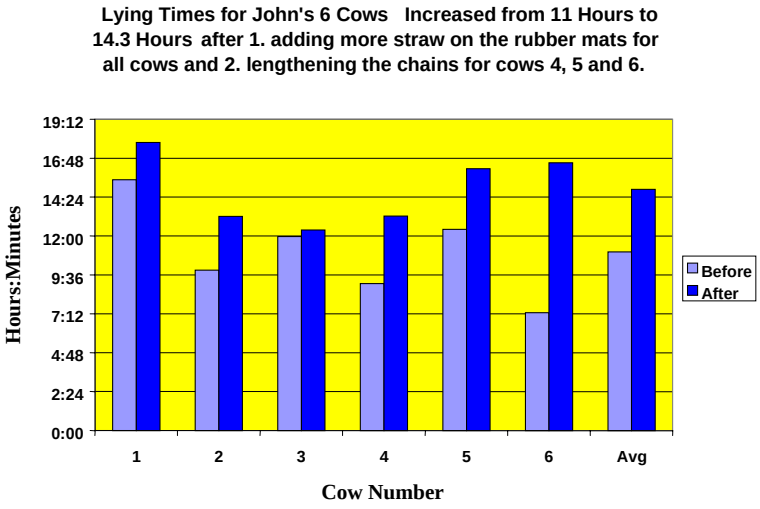
Table 1. Measurements of cow length, width, and rising space for UK Friesian-Holsteins.

Length - nose to tail head	240 cm (95 in)
Imprint length	180 cm (71 in)
Imprint width	120 cm (47 in)
Length of head lunging space	60 cm (24 in)
Length of front-leg stride to rise	45 cm (18 in)

Faull concluded that Friesian/Holstein cows at pasture required about 240 cm (95 in) x 120 cm (47 in) living space and a further 60 cm (24 in) of lunging space for rising. Using these standards, they found 87 percent of cubicles were too short, 50% were too wide or too narrow, and that only 12% of the cubicles permitted real freedom of movement. Fully 10% of cows appeared moderately or severely restricted when lying down, 33% when rising and 55% when standing. Using Faull's measurements, the total stall length should be 300 cm (118 in) (240 cm plus 60 cm) for UK Friesian-Holsteins. Mature Canadian Holstein-Friesians have a nose-to-tail length of 235-245 cm (92.5 - 96.5 in) (Haley, 2000), similar to the cattle in Faull's report.

In Switzerland, animal welfare legislation includes guidelines for positioning of brisket boards to define the resting area of freestalls. Brisket boards must be positioned 185 cm (73 inches) from the rear curb and they must not extend more than 10 cm (4 inches) above the lying surface. These measurements are for cows with a withers height of 135±5 cm (53±2 inches). (Katharina Friedli, Personal Communication, 2001)

In Ontario, some barns are being built with 244-cm (96-in) long stalls (curb to wall), loops placed on 117-cm (46-in) centers to set stall width, and 15 - 25-cm (6-10-in) high brisket boards located 168 - 173 cm (66-68-in) from the rear curb. Some have solid concrete or piles of bedding ahead of the brisket board. The brisket boards and concrete are obstructions to the normal stride taken when rising. Some producers are still building stalls that do not meet the space requirements for Canadian Holsteins.



In tiestall barns, short platforms, narrow stalls, high manger curbs, low tierails, and short tiechains alter normal cow behaviour and rest. The video portion of this presentation shows cow behaviour in three tiestall barns. The adjacent histogram shows resting time increased from 11 hr to 14.3 hr after two simple changes in John's barn - longer tie chains and more straw on the rubber mats. The data from VTR convinced John to make husbandry changes and look for improved foot health. There are reports of associations of reduced lying times with lameness (Colam-Ainsworth, 1989; Leonard, 1996) and social behaviour and lameness (Galindo, 2000).

Restlessness and Stallsores

Restrictive stalls lead to restlessness. In the adjacent photograph, notice that the brisket board prevents the cow from extending her front legs forward. Nonetheless, she can extend her upper front leg laterally – one commonly seen when in the "dead cow resting position" while resting fully on her side. The brisket board positions her towards the curb, her leg and tail hang into the alley.

When viewed on video, cows in similar stalls changed positions several times per hour. Their top hindlegs moved into and out of the alley 15 to 30 times per hour and their bottom hindleg moved across the mattress 6 to 10 times per hour (Anderson, Pace & Douglas, 2000).

After viewing the video taken at his farm, one owner removed the brisket boards and raised the neckrail to 127 cm (50 in) above the mattress. Stall usage and cow behaviour changed immediately. Within six months, the majority of the hock lesions had healed. Researchers have reported on hock lesions and the stall surface or bedding (e.g. Weary, 2000; Wechsler, 2000). However, these reports do not include the confounding influence of other stall features. If stall features cause restlessness, and if restlessness leads to excessive leg movements and abrasions, stall characteristics that lead to a more restful lying experience could prevent hock sores in mattress barns.

Measurements for New Stalls

Recently, manufacturers and contractors introduced several stall features that provide superior freedom to lie, rise and rest comfortably. Many are using PolyPillows® rather than brisket boards. Some producers have chosen not to have any form of brisket restraint. New stalls for Canadian Holsteins (front lunging) have open fronts with loops supported independently so there are no obstructions at the front of the stall. Neck rails are 122 - 127 cm (48 - 50 in) above the mattress and positioned 160 - 167 cm (63 - 66 in) from the rear curb according to cow size.

In retrofitting barns where side lunging is unavoidable, the top bar of the loop

becomes the neckrail. For this application, there is a special loop with a wider opening between the top and bottom bar with the top bar at neckrail height - 122 - 127 cm. New freestalls are also wider 121 cm (48 in) and longer. The platforms for head-to-head stalls are now being built at 503 cm (198 in) and 275 - 305 cm (108 - 120 in) when a wall is at the front. The new front-lunging freestalls allow cows to stand straight in the stall, to lie straighter, and to have their tails rest on the platform while lying.

For their tiestall barns, owners are installing the single tierail 121-cm (48 in) above the mattress and 35 cm (14 in) forward of the manger curb in barns with 183-cm (72-in) platforms. Several producers built stalls for their biggest cows with the tierail 127-cm (50 in) above the mattress and 25 cm (10 in) forward of the manger curb. Stall widths and platform lengths vary from 137 cm (54 in) wide and 173 cm (68 in) long for first lactation heifers, to 152 cm (60 in) wide and 183 cm (72-in) long for the largest cows. The most common stalls are 137 cm (54 in) wide and either 178 - 183 cm (70 - 72 in) long. The new stalls provide 56 - 61 cm (22 - 24 in) unobstructed access to water bowls. Tie chains need to be 102 cm (40 in) long for stalls with 121-cm (48-inch) tierails. Several barns have stalls of three sizes for cows in three size ranges.

Fecal contamination of the lying area will vary with the stall design (Herlin, 1994, 1997). The cleanest stalls will be those with the lowest occupancy rate. Innovative producers are choosing stalls for her comfort and compromising by investing more labor in stall maintenance. They know that stalls in use get dirty and those not in use stay clean.

Attitude and Opinion – Benefits of Change

With the help of VTR, researchers are dispelling common dogma about husbandry systems and cow comfort and bringing us valuable information about housing and health. Dairy producers, sensitive to injuries and disease, often lead the way or actively look for safety features to minimize apprehension and abnormal behaviour, and to improve cow health, comfort, dignity and performance. For the doubters, VTR are powerful tools for changing attitude and opinion and enabling change. VTR show what cows do in barns - something producers need to get from contractors and designers before building their barn.

Our Canadian cows are in the midst of an epidemic - an epidemic of change in stall design and barn construction. This epidemic is being fueled by several very perceptive producers, equipment designers and contractors. Although there are no formal research projects to assess the benefits, the anecdotal reports appear frequently in our farm press - less culling, more milk and better health. The cows definitely keep up their end of the bargain when their owners keep theirs.

"I used to believe that too, but I don't anymore" has become a useful part of my vocabulary since using VTR for diagnosis and outreach activities. After seeing this video, perhaps you will use it too.

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