

# Training Göttingen Minipigs

## Using Operant Conditioning Behaviour Analysis (“Clicker Training”) for Dermal Safety Studies

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The Göttingen minipig is a widely used large animal model in preclinical dermatological drug safety studies. Using standard restraint techniques (slings, etc.), applying topical compounds to the backs of minipigs can be challenging because minipigs are often fractious. This can lead to injuries to animals or staff, as well as inaccuracies in dosing and even contamination.

Operant conditioning behaviour analysis (“clicker training”) is used with many species for general care and research, and has been used with pigs in discrimination research, animal welfare research, cognitive science, and animal science and husbandry. At Pfizer Global Research and Development - Drug Safety Laboratories and Comparative Medicine in Ann Arbor, Michigan, USA, the goal was to use this training method to train minipigs to voluntarily cooperate with husbandry and experimental procedures, primarily for dermal toxicology studies. By pairing the

sound of a click with food, animals learned that they would be rewarded for performing specific behaviors.

Each animal’s food rations for the day were placed in a small plastic bucket attached to its kennel (Figure 1); each “click” earned the animal a few food pellets. At the end of the day, any remaining food was fed out to the pig, ensuring that the animals received only their normally allotted rations. Enrichment foods (bananas, etc.) were given to the minipigs at the end of the training session as a “jackpot”.

We utilized the “protected contact” model of physically handling the animals as little as possible; this was advantageous for handler safety and non-contamination during experimental procedures. For example, minipigs received their food pellets from a small frying pan rather than from the trainer’s hand.

Animals were trained to touch and then follow a target stick (large plastic spoon) (Figure 2). When comfortable with this exercise, minipigs were then trained to walk into the bottom half of a standard plastic shipping crate, equipped with a piece of matting on the bottom for improved traction. A target (plastic disk with a hole drilled through it) was installed at the end of the crate, along with a ladle (Figure 3). The animals easily generalized from touching the target stick to touching the installed target and receiving the pellets in the ladle rather than the frying pan, freeing the technicians’ hands for study procedures. All study procedures could be done in the animal’s home pen, further reducing chances of contamination, as crates, target sticks, etc., could all go through cagewash. Minipigs could also be moved out of the home pen by following a target stick into a shipping crate on a scale (Figure 4) for body weight determination, or onto a cart for transport within the institution.

Table I shows the shaping plans used for to train the desired behaviours. The trainer graded each animal’s proficiency/fluency for each step of each behavior and the results were documented. Progression to the next step or behavior was dependent upon the animal’s competence. Training lasted approximately ten minutes per business day



**Figure 1:** A typical minipig kennel pen set-up, including moveable plastic food buckets. Minipigs are individually housed, but can see each other in adjacent and opposite pens.

per pig over a 2.5-week period. An approximate training schedule is shown in Table 2. Using this protocol, behaviors were strong enough to maintain excellent behavior through a thirty-day study period. Some animals kept in house for up to 6 months retained the behaviours even without regular maintenance training. Age made little difference in the trainability of the minipigs. When designing training plans for novel behaviours, extra time will be required to develop appropriate and efficient shaping plans.

Setting up the bargain (Click = Treat) with the animal is generally called “charging the clicker”. The minipig indicates understanding of the “bargain” by looking at the trainer for the click. Every time the trainer clicks, the animal must receive a treat, even if the click was made by mistake. As training progresses, the click itself can be given on a variable schedule for a particular behaviour, requiring the animal to do several repetitions of the behaviour to earn the click, or the timing can be delayed to shape the behaviour for increased duration.

Head turns are an essential but often overlooked tool in “clicker training”. As soon as the animal understands that Click = Treat, teaching headturns shows the minipig that it can modify its behaviour and physically do something to earn the reward. It also serves to improve the trainer’s technique and timing. When the animal looks to one side (arbitrary, but consistent within a training session), even just a glance, it is rewarded with a click. The motivation for the movement is not important. When the animal is consistently rewarded for glancing or moving its head toward the chosen side, it quickly learns how to “make” the trainer click. Head turns are also useful as a “backup” behaviour: if an animal is frustrated with an exercise, it will often start to offer head turns instead of jumping on, or biting the trainer. No commands are necessary at this level of training – the position of the trainer and equipment act as cues.

Integral to the success of this program was a core group of technicians using well defined protocols. Five technicians



**Figure 2:** Minipig following a target stick

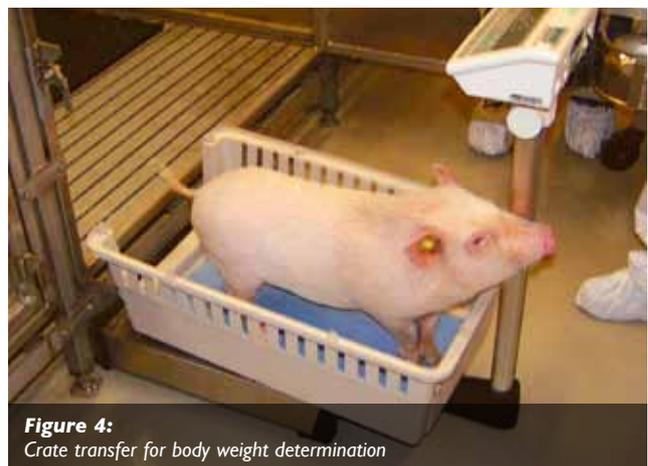


**Figure 3:** Animal shipping crate with mat, ladle and installed target

who expressed special interest received advanced training in operant conditioning behaviour analysis, and helped train and supervise the numerous other technicians involved either pre- or on-study. One of these core trainers was study monitor for each minipig study. Although some were initially dubious, staff bought in to the program once they saw how easy (and fun) it was, and the major difference in overall minipig behaviour.

Defined shaping plans were used to train each behaviour, and records were kept for every training session for each animal. We tracked the amount of time spent on each behaviour and step of the training, monitored the progress of individual animals, and made changes to protocols as necessary. This also gave us the metrics necessary to demonstrate the progress and success of the programme to senior staff.

When beginning a training session, the technician refers to the animal’s most recent training logs to decide what behaviour and step of the shaping plan to begin with. Training logs were made as simple as possible: the behaviour and step in the shaping plan, number of minutes and trials of each step, and animal’s proficiency at that step could all be either circled from a list or written as an abbreviation, followed by a short comment as necessary.



**Figure 4:** Crate transfer for body weight determination



## TRAINING GÖTTINGEN MINIPIGS

**TABLE 1:** Shaping plans for each of the desired behaviours. Each training session is documented; a new step is not attempted until the animal is confident with the previous step.

<b>“Charge Clicker”</b>	<p>Click and put pellets in pan (Click and treat; C&amp;T); repeat</p> <p>Continue until animal is confident and looks for the food after the click</p> <p>Move pan around to acclimate animal to being in different areas relative to the trainer</p>
<b>Head Turns</b>	<ul style="list-style-type: none"> <li>• C&amp;T when the animal looks to the left or the right (pick one)</li> <li>• Initial motivation for the head turn is irrelevant</li> <li>• C&amp;T for a larger head turn</li> <li>• C&amp;T for a longer head turn</li> </ul>
<b>Target Stick</b>	<ul style="list-style-type: none"> <li>• C&amp;T for interest in target stick (plastic spoon)</li> <li>• C&amp;T for closer proximity to the target stick</li> <li>• C&amp;T for touching target stick on flat end</li> <li>• C&amp;T for touching target stick longer</li> </ul>
<b>Crate Training</b>	<ul style="list-style-type: none"> <li>• Use target stick to lure minipig into crate, feed from the pan</li> <li>• Advance into crate at ~1 foot intervals. Do not advance until minipig is confident at each step (1 foot in crate, 2 feet in crate, etc.)</li> <li>• As minipig approaches the end of the crate, place the food into the installed ladle rather than the pan</li> <li>• Guide the minipig out of the crate with target stick (back up or turn around, depending on the size of the animal)</li> <li>• Feed from the pan in the pen outside of the crate</li> </ul>
<b>Fixed Target in Crate</b>	<ul style="list-style-type: none"> <li>• When minipig is confident standing in the crate touching target stick, place the target stick over the installed target</li> <li>• C&amp;T for touching the installed target instead of the target stick</li> <li>• Crate Transfer</li> <li>• Set up the crate outside the pen (on cart, scale, etc.)</li> <li>• Use target stick to guide minipig into crate, C&amp;T for touching stick</li> <li>• C&amp;T for touching stationary target</li> <li>• Guide out of crate with target stick</li> <li>• C&amp;T when back in pen</li> </ul>
<b>Dermal Dose Training (use two trainers – one to dose, one to C&amp;T)</b>	<ul style="list-style-type: none"> <li>• C&amp;T for touching the target during the following:</li> <li>• Start with hand resting on crate</li> <li>• Move the hand into air over the animal</li> <li>• Put hand over animals back</li> <li>• Let hand rest on animals back</li> <li>• Gently stroke animals back</li> <li>• Rub animals back</li> <li>• Acclimate animal to dosing rod as with hand</li> <li>• Acclimate animal to dosing procedure using water</li> </ul>

**TABLE 2:** Example of a training schedule with goal training activities for each day. Some animals may progress more quickly than others; new behaviours should not be attempted until previous behaviours are fluent. Each day’s training session averages 10-15 minutes per pig. In order to facilitate technicians’ schedules, no training is done on weekends. new step is not attempted until the animal is confident with the previous step.

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
			Animals arrive on site	No training	No training	No training
<p>Training begins</p> <ul style="list-style-type: none"> <li>• Charge clicker</li> <li>• Head turns</li> </ul>	<ul style="list-style-type: none"> <li>• Head turns</li> <li>• Target stick</li> </ul>	<ul style="list-style-type: none"> <li>• Head turns</li> <li>• Target stick</li> </ul>	<ul style="list-style-type: none"> <li>• Target stick</li> <li>• Crate training</li> </ul>	<ul style="list-style-type: none"> <li>• Target stick</li> <li>• Crate training</li> </ul>	No training	No training
<ul style="list-style-type: none"> <li>• Target stick</li> <li>• Crate training</li> <li>• Crate transfer</li> </ul>	<ul style="list-style-type: none"> <li>• Crate training</li> <li>• Crate transfer</li> <li>• Dermal dose training</li> </ul>	<ul style="list-style-type: none"> <li>• Crate training</li> <li>• Crate transfer</li> <li>• Dermal dose training</li> </ul>	<ul style="list-style-type: none"> <li>• Crate training</li> <li>• Crate transfer</li> <li>• Dermal dose training</li> </ul>	<ul style="list-style-type: none"> <li>• Crate training</li> <li>• Crate transfer</li> <li>• Dermal dose training</li> </ul>	No training	No training
Study Initiation	Study procedures include: clipping, dermal dosing, electrocardiograms, body weight collection, physical examinations, etc.					

If a problem or question arose in a training session, the technician was advised to leave the pen, problem solve and revise the shaping plan appropriately before reengaging with the animal. Trainers were able to help each other identify timing or position issues. Experiencing how quickly the training sessions translated into observable behavioural changes was rewarding for the technicians, and a team atmosphere developed among the trainers

The equipment used was simple and functional. The clicker (iClick models were preferred, as they can be touched from any angle) could be taped to the handle of the target stick or the pan for easy access. Feeding out of the pan reduced the need for the animal to move around the floor to ensure that all pieces were eaten, which both sped things up and kept the pig engaged in the activity. The ladle served the same function in the crate. The bucket containing food was hung from the pen wall at a place that was accessible to the trainer without being distracting to the pig.

To efficiently train an exercise, and reduce frustration for the trainer and the animal, it was helpful to physically practice the series of movements outside of the pen before beginning the exercise. Occasionally, having another trainer “act” as the pig would help with the timing or movement issues. For most activities, only one trainer was needed; however, for dermal dose training, two trainers were involved. One technician would click and treat, and the other would practice perform the dosing procedures (using water instead of compound). This could be theoretically done using one technician and an automatic feeder, our study protocols require two technicians to be present during dosing, which worked well for our training needs.

In the past, minipigs were brought into the facility four weeks prior to study initiation. A technician spent 15 minutes per animal per day in the pen with the minipig to acclimate it to the presence of humans and allowing touching. Rather than taking longer than the traditional procedures, operant conditioning protocols allowed an unanticipated time savings. Documenting and timing every training ses-



sion allowed us to quantitate the actual time required to run this training programme. As detailed in Table 3, a 24 pig study saved an average of 72 technician hours during the pre-study period. Once on-study for 7 days, 28 technician hours were saved. Thus, for a 7 day, 24 minipig study, there was an average time savings of 100 technician hours. This did not include the time saved on physical examinations, electrocardiograms, body weight determinations, clipping, etc. The significant time savings frees technicians for other studies, and also allows a greater number minipig studies to be run each year.

Using operant conditioning to train minipigs in our facility resulted in significant reductions in a) injuries to animals and staff, b) stress levels of animals and staff, c) the number of staff required for study procedures, and d) the number of technician hours required compared to previous protocols. This training enriches the animals’ environment and their interactions with handlers. Technicians trained in the techniques of operant conditioning behaviour analysis gain a valuable skill set which can be used with any research species. Operant conditioning is a cost-effective way to provide a positive environment for animals and staff, and has ergonomic and economic benefits.

**TABLE 3:** Documentation of every training session allowed us to quantitate the time required to run this training programme. Operant conditioning protocols resulted in significant and unanticipated time savings.

<b>Pre-Study</b>	<b>Traditional Acclimation</b>	<b>Operant Conditioning</b>
Pig arrival time required pre-study	4 weeks (20 training days)	2.5 weeks (12 training days)
Total average acclimation/ training time required (per pig)	5 hours (15 min / day)	2 hours (10 min / day)
Average preparation time for a 24 pig study	120 technician hours	48 technician hours
<b>On Study</b>		
Staff required per pig for dermal dosing	3 technicians	2 technicians
7 day, 24 pig study, once daily, 10 min dosing	84 technician hours	56 technician hours
<b>Overall</b>		
Total time required	204 technician hours	104 technician hours
<b>Time savings on one 7 day study*</b>	<b>100 technician hours</b>	

\* Not including time savings on physical examinations, electrocardiograms, body weight determination, clipping, etc.