

For a significant part of their waking hours, young pigs are engaged in a variety of social interactions, which range from obviously playful gambols to fierce and severely injurious fighting. For several reasons, it is important to understand the factors that determine the type, duration and intensity of interactions between young pigs. On the one hand, fighting jeopardizes both welfare and bodyweight gain of millions of these animals kept on commercial farms. On the other hand, social play may prepare them to cope better with the often harsh life in modern intensive housing systems. Besides having practical importance, understanding pig play is interesting from a comparative perspective since pigs are unique among ungulates in having so numerous litters.

#### EXPERIMENTAL APPROACH

We designed an experiment in which we wanted to assess the importance of pre-weaning social experience for later social behavior. We gave 8 litters each either a standard, reduced or enriched experience with social interactions during the suckling period, and tested their social behavior after weaning. The testing proceeded with 4 pigs (either all from the same litter or two pairs from two litters) interacting in a 2 x 2 m arena. We knew that in pig fights and pig play, mutual spatial positions of the two contestants are important [1]. The attacking pig tries to achieve a spatial conformation in which it is positioned parallel to perpendicularly to the other pig and has its mouth at the level of the opponent's ears or neck, so that it is within biting distance from the ears, neck or shoulder of the opponent. The counter strategy of the other pig may be defensive, in that it turns away from the attacker by



rotating the body. It can also react by turning quickly towards the attacker, trying to achieve an attacking position itself. When the fight is not yet decided but the pigs are exhausted, they often rest in a symmetrical anti-parallel position - something like a clinch in boxing. For a human observer, it is impossible to score these positions directly, as the mutual orientation of both opponents may change several times per second. Manually scoring from videotape is possible, as the interactions are basically two-dimensional. In this case, an overhead camera provides a very good view. But pausing the tape (or a digital video file) every few frames and scoring the mutual positions manually is extremely time-consuming. To automatically score the mutual position and orientation of the two pigs, we needed a tracking system that could track two markers on the body of each animal.

*Camera view from the arena with the four pigs. In addition to a color mark, pigs have a number on their back to identify them in their home pens. The counter in the corner is used for manual screening and scoring.*

#### USING ETHOVISION TO TRACK COLORED PIGS

EthoVision Color-Pro provided the solution, allowing us to track several differently colored objects at a time. After some pilot trials to find the optimal combination of colors, we marked one focal pig with a large blue area on the neck and top of its head, and a large green area just behind the shoulders. The other focal pig was marked orange on its head and neck and pink on the back. The other two pigs were not marked. The above combination proved satisfactory, but could not prevent that the system sometimes could not find the "object" in question or detected a false location. For example, a piece of straw was confused for the green object, or a light reflection on the black

painted plywood walls was taken as the blue marker. EthoVision offers the option to correct individual tracking points manually, but the amount of data in this study precludes this, as 10 minutes of tracking amounts to 3000 data points for each color and our goal is to analyze 6 tests in each of 24 groups of 4 pigs.

#### **FROM TRACKING DATA TO PIG POSITIONS**

To automate the correction process, we wrote a program in FoxPro that cleans up the data and calculates the mutual positions of the two pigs from the co-ordinates of the four color markers. The first task, cleaning up the data, is achieved in three steps. First, the system identifies invalid data points. It then replaces these invalid data points by interpolations calculated from the nearest correct positions of the object. Finally, it checks once more whether the interpolated values meet a criterion of a reasonable distance between the two markers on the same piglet. After this pre-processing step, an algorithm is applied that calculates, in three runs, the mutual position of the two pigs. First, the positions of the snouts and the tails of the two colored pigs are calculated by extrapolating the "head marker - back marker" vectors into the appropriate directions. For this purpose, the relative lengths "snout - head marker", "head marker - back marker" and "back marker - tail" were measured from the screen for each pig individually, and were used as parameters in the algorithm. In the second run, it is determined per interval how close the pigs are to each other and which of them is "active", i.e. has its snout nearer to the body of the second one. The whole two-pig configuration is rotated in the second run so that the passive pig has its snout at  $x=0, y=0$  point and its body falls on the negative half of the  $y$ -axis. Finally, the angle of the two bodies and the point of contact are calculated. For our purposes, we classified all possible positions into contact - non contact, 3 basic orientations (parallel, anti-parallel and perpendicular) and 2 classes according to whether the active piglet was snout-contacting the other either in front or behind the ear base.

#### **VALIDATION**

Currently, we are evaluating the agreement of the automatically scored positions with positions scored at the same frames manually. Once this is ready, the combination of EthoVision Color-Pro and the custom-built FoxPro program will allow us to score both absolute and mutual positions of the pairs of marked pigs in all our tests, and extract a lot of information about the development and strategies in play and fighting, which would otherwise remain dormant in the hundreds of thousands of video frames.

#### **REFERENCE**

1. Rushen, J.; Pajor, E. (1987). Offence and defence in fights between young pigs (*Sus scrofa*). *Aggressive Behaviour*, 13, 329-346.

#### **CONTACT INFORMATION**

Marek Spinka, Pavel Sustr and Ruth Newberry. Research Institute of Animal Production, Prague, Czech Republic  
E-mail: spinka@novell.vuzv.cz address