

The odour of the human breath can drive avalanche search and rescue dogs to discover a buried victim under the snow.

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The authors declare they have no conflict of interest.

Avalanche search and rescue dogs play a vital role in the survival of the disperse victims because their extraordinary olfactory sensitivity allows them to detect and discriminate different components of the human body scent even under the snow. This is crucial if we consider that the “survival probability” of avalanche buried victims decreases rapidly, presenting a dramatic drop 18 min after burial, depending on a variety of environmental and human factors (Brugger, 2001; Haegeli et al., 2011). Notwithstanding research identified the compounds that characterize the odour of humans (Wackermannová et al., 2016), still is unknown how dogs perceive them and which components could be considered an human-specific marker per se, allowing search and rescue dogs to find a disperse victim.

We hypothesized that when a person is buried under the snow for a longer time than the drop of survival curve and develops a progressive hypothermia with reduction of the air exchanges, could be still located by the human odour compounds which already reached the snow’s surface. But which components of the human scent steer the dogs? Among these, which one could represent a human-specific marker allowing, per se, the detection of a disperse person? This study was aimed to assess if search and rescue dogs are able to locate a “buried victim” only by perceiving the human’s breath under the snow in an avalanche simulate context, and if there are some dog’s body postures which can be representative of a successful search.

Fifteen SAGF (Alpine Rescue of Guardia di Finanza) Units were used for the study. A wide snow area was subdivided and prepared in 15 limited fields (25m x 25m), one for each SAGF Unit. In each field, an operator blew for 18 minutes inside a 20-meter long tube buried under 1 m of snow. After a 20-minute break, the SAGF Unit had to find the “buried victim”, i.e. the breath coming out from the hidden tube within 15 minutes time. The trial was considered successful when the SAGF dogs signalled the human breath and found the end part of the buried tube. Each SAGF Unit replicated the trial. We collected SAGF Units performance data (latency time for detection, success rate) and dogs’ postures (modified from Diverio et al., 2017 and Hasegawa et al., 2014).

SAGF-Units performed successfully most of the trials (27/31, 87%; $P < 0.0001$). Success rate was not affected by dog’s gender (male=91%, female=78%), age (≤ 5 years=77%, > 5 years=94%) or breed (German Shepherd=90%, Belgian Malinois=100%, Border Collie=88%, Labrador=50%, Mixed=67%), and trial’s number (first replicate=93%, second replicate=80%).

The mean and standard error of latency time (time used to find the tube) were 3.3 ± 0.6 minutes, ranging from 1 to 15 minutes. More than 18% of trials ($n=5$) had a latency time of 1 minute and it was lower than 2 minutes in more than 50% of trials ($n=14$). Only 2 trials had a latency time greater than 7 minutes. Latency time was not affected by dog's gender (male=3.5 minutes, female=2.9 minutes), age (≤ 5 years=3.5 minutes, >5 years=3.2 minutes) or breed (German Shepherd=3.0 minutes, Belgian Malinois=2.8 minutes, Border Collie=5.0 minutes, Labrador=1.0 minute, Mixed=2.5 minutes), and trial's number (first replicate=2.8 minutes, second replicate=4.1 minutes).

During the search, dogs spent most of the time ($P < 0.0001$) with the head low (78%) and facing down (79%), neutral posture (91%), back parallel tail (50%), ears forward (74%) and closed mouth (64%). On successful trials, dogs spent more time with a high posture ($P < 0.001$), head low ($P < 0.05$) and facing down ($P < 0.01$), vertical tail ($P < 0.01$), and ears forward ($P < 0.05$) compared with failed trials.

The elevated success rate indicates that avalanche search and rescue dogs can be driven exclusively by the odour of the human breath emerging on the snow surface to locate a "buried victim". However, further studies are needed to clarify how environmental factors might affect the detection rate and which volatile or semi volatile components of the human breath are perceived by dogs and used as a marker of the presence of a person.

References

- Brugger H., Durrer B, Adler-Kastner L., Falk M., Tschirky F., 2001. Field management of avalanche victims. *Resuscitation*, 51: 7–15.
- Diverio S., Menchetti L., Riggio G., Azzari C., Iaboni M., Zasso R., Di Mari W., Santoro M.M., 2017. Dogs' coping styles and dog-handler relationships influence avalanche search team performance. *Applied Animal Behaviour Science*, 191: 67-77.
- Haegeli P., Falk M., Brugger H., Etter H.J., Boyd J., 2011. Comparison of avalanche survival patterns in Canada and Switzerland, *CMAJ (Canadian Medical Association Journal)*, 183: 789–795.
- Hasegawa M., Ohtani N., Ohta M., 2014. Dogs' body language relevant to learning achievement. *Animals*, 4: 45-58.
- Wackermannová M., Pinc L., Jebavy L., 2016. Olfactory Sensitivity in Mammalian Species. *Physiological Research*, 65: 369-390.