Rapid Scent Imprinting for Detection

Dogs

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Defence Science and Technology Laboratory

UK
Defence Science and Technology Laboratory

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  - Industry
  - International collaboration with government research agencies
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  – Understanding current canine capability
  – Supporting operational teams
  – Optimising performance
  – Developing new capabilities
Rapid Imprinting Trial

The aim of this pilot study was to understand how training schedule affects odour learning and memory:

- To determine whether dogs can be effectively trained over very short training periods
- To determine whether dogs can successfully recall trained odours after short and long periods without encountering the odour in the interim
Dogs

• Six dogs
  – Belgian Malinois, Springer Spaniel, German Shepherd, Labrador Retriever, Dutch Shepherd, Cocker Spaniel
• All aged between 1.5 - 3 years old at start of the trial
• All had received initial training on search technique and two odours
## Training schedules

<table>
<thead>
<tr>
<th>Training Schedule</th>
<th>No. of Rewards</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5 days training</td>
<td>?</td>
</tr>
<tr>
<td>1 days training</td>
<td>?</td>
</tr>
<tr>
<td>3 days training</td>
<td>?</td>
</tr>
<tr>
<td>5 days training</td>
<td>?</td>
</tr>
<tr>
<td>0.5 days training plus training on two additional odours</td>
<td>?</td>
</tr>
<tr>
<td>3 days training plus training on additional odours</td>
<td>?</td>
</tr>
</tbody>
</table>
How many rewards?

- Training observed for one week
  - Stand based training
  - One handler with six dogs
- Average of 26 rewards per dog per day
Stand based training
Training schedules

<table>
<thead>
<tr>
<th>Training Schedule</th>
<th>Rewards</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5 days training</td>
<td>13 rewards</td>
</tr>
<tr>
<td>1 days training</td>
<td>26 rewards</td>
</tr>
<tr>
<td>3 days training</td>
<td>78 rewards</td>
</tr>
<tr>
<td>5 days training</td>
<td>130 rewards</td>
</tr>
<tr>
<td>0.5 days training plus training on two additional odours</td>
<td>5 rewards (4 rewards each on two additional odours)</td>
</tr>
<tr>
<td>3 days training plus training on additional odours</td>
<td>26 rewards (26 rewards each on two additional odours)</td>
</tr>
</tbody>
</table>
Trial design

- Balanced latin square
  - Six odours
  - Each training schedule was completed once by each dog
  - Each of the odours was used once for each schedule
  - Order effects were limited

<table>
<thead>
<tr>
<th>balanced</th>
<th>A</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dog 1</td>
<td>half</td>
<td>five</td>
<td>one</td>
<td>three&amp;two</td>
<td>three</td>
<td>half&amp;four</td>
</tr>
<tr>
<td>Dog 2</td>
<td>five</td>
<td>three&amp;two</td>
<td>half</td>
<td>half&amp;four</td>
<td>one</td>
<td>three</td>
</tr>
<tr>
<td>Dog 3</td>
<td>three&amp;two</td>
<td>half&amp;four</td>
<td>five</td>
<td>three</td>
<td>half</td>
<td>one</td>
</tr>
<tr>
<td>Dog 4</td>
<td>half&amp;four</td>
<td>three</td>
<td>three&amp;two</td>
<td>one</td>
<td>five</td>
<td>half</td>
</tr>
<tr>
<td>Dog 5</td>
<td>three</td>
<td>one</td>
<td>half&amp;four</td>
<td>half</td>
<td>three&amp;two</td>
<td>five</td>
</tr>
<tr>
<td>Dog 6</td>
<td>one</td>
<td>half</td>
<td>three</td>
<td>five</td>
<td>half&amp;four</td>
<td>three&amp;two</td>
</tr>
</tbody>
</table>
Testing

• Tested using Odour ID test protocol
• Eight stands per run
• Dogs work on lead – search each stand once
• 1 target odour and 7 distractor odours
• 5 positive runs, 1 blank run
• Between each run, target and 2 distractor odours replaced
• Tested at 1 day, 1 week, 2 weeks and 6 month time intervals

Results – Initial learning

Detection Rate

- 5 rewards
- 13 rewards
- 26 rewards
- 26 rewards
- 78 rewards
- 130 rewards

Training Schedule

Plus additional odours

Detection Rate

False Alarm Rate
Results - memory

![Bar chart showing detection rates over time](chart.png)

- **Detection Rate**
- **False Alarm Rate**

**Time since last exposure to target odour**

- 1 Day
- 1 Week
- 2 Weeks
- 6 Months
Conclusions

- Dogs given limited training (13-26 rewards) on a new odour had high detection rates (64-87%) immediately after training.

- Training on multiple unrelated novel odours appears to be more challenging than training on a single odour (26 versus 26+additional odours).

- Dogs are able to remember an odour for up to six months without any exposure to that odour, when tested using an Odour ID test.
Recommendations/next steps

• Collect data on larger sample size
• Determine whether this speed of odour learning is possible in realistic search scenarios
• Test odour recall in operationally realistic search scenarios following stand based training, stand based plus minimal search training and search training only
• Determine whether a dog’s ability to generalise to odours related to their training target (e.g. different variants) is affected by limited training time and/or long periods of non-exposure to the target odour
Questions?

Special thanks to the staff at the Defence Animal Centre, UK MOD