Different influences of varying the number of daily training trials on learning on frequency- and temporal-interval discrimination

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Introduction
The acquisition of many perceptual skills proceeds over a course of days. However, little is known about how much daily training is needed for such multiple-day learning to occur. Here we investigated this question by examining how varying the number of training trials per day affected learning over multiple days on two auditory discrimination tasks: frequency discrimination and duration (temporal-interval) discrimination. The results suggest that improvement on auditory discrimination tasks requires some critical amount of training per day, that training beyond this critical amount yields no additional learning on the trained condition, and that the critical amount of training needed varies across tasks. This information could help improve the efficiency of perceptual training regimens.

Results: Frequency Discrimination
More than 360 training trials per day were needed for learning on the frequency-discrimination task.

The mean daily thresholds changed significantly over days for listeners who practiced 900 trials per day, but not for those who practiced 360 trials per day.

Results: Duration Discrimination
360 training trials per day were sufficient for learning on the duration-discrimination task, and additional daily training beyond this amount did not contribute to learning on this task.

The mean daily thresholds changed significantly over days for both the 360- and the 900-trials/day groups, suggesting that the daily trials beyond 360 were superfluous.

Conclusions and Discussion

• Learning on auditory discrimination tasks over multiple training sessions requires some critical amount of training per day, and this critical amount differs across tasks.
  • For frequency discrimination, >360 training trials per day were needed for learning on the particular condition trained here, but it appears from a previous experiment that fewer trials may be needed for longer-duration stimuli.
  • For duration discrimination, the critical number of trials per day is likely between 50 and 360, because training 50 trials per day for 20 days yielded no learning on a similar condition in a previous report, while training 900 trials per day did.
• These results are consistent with two other reports of learning on a cognitive task.

Training beyond this critical amount yields no additional learning on the trained condition.
• Training more than 360 trials per day did not contribute to learning on the trained duration-discrimination condition.
• This outcome is similar to that reported for learning on three other non-auditory tasks.

Thus, auditory training regimens could be made more efficient by providing only the critical amount of training needed for learning on the trained condition each day.

General Method
Procedure
- two-interval, forced choice, with feedback
- adaptive, 3 down/1 up (79.4% correct)
- 60 trials per threshold estimated

Standard Stimulus used for Training
- two 15-ms tone pips
- 1 kHz, 86 dB SPL
- onsets 100 ms apart

Tasks
- Frequency discrimination
- Duration (temporal-interval) discrimination

Training Regimens

<table>
<thead>
<tr>
<th>Group</th>
<th>Task</th>
<th>Daily # of</th>
<th>Total # of</th>
<th>Total N</th>
</tr>
</thead>
<tbody>
<tr>
<td>F360</td>
<td>Freq.</td>
<td>360</td>
<td>2460</td>
<td>41</td>
</tr>
<tr>
<td>F900</td>
<td>Freq.</td>
<td>900</td>
<td>5700</td>
<td>95</td>
</tr>
<tr>
<td>D360</td>
<td>Dur.</td>
<td>360</td>
<td>2460</td>
<td>41</td>
</tr>
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<td>D900</td>
<td>Dur.</td>
<td>900</td>
<td>5700</td>
<td>95</td>
</tr>
</tbody>
</table>

*includes 300 trials (5 threshold estimates) from a pretest

Footnotes

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Pre
Pre
F 360
F 900
F 360
F 900
F 360
F 900
D 360
D 900
D 360
D 900

Was the greater learning with more daily practice due to the amount of daily practice or to the total number of trials practiced?
To answer this question, we reanalyzed the data, but fixed the total number of training trials at 2460 (41 threshold estimates). Thresholds changed significantly across these first 41 estimates for listeners who practiced 360 trials per day, but not for those who practiced 360 trials per day, indicating that the key factor was the amount of training per day.

Further, the learning rate over the first 41 estimates was significantly slower in listeners who practiced 900 trials per day than in those who practiced 360 trials per day. The slower improvement with more daily training indicates that the additional trials beyond 360 per day did not contribute to learning as effectively as the first 360 trials per day.