Are SL abilities independent across domains in children? How do visual and auditory SL abilities each contribute to individual’s language skills? If so, how are SL abilities from different domains associated with children’s language skills?

Background

- Statistical learning (SL) is fundamental for first language acquisition.
- Variabilities in SL in both auditory and visual domains have been associated with children’s vocabulary, grammar and reading abilities.

In adults (Siegelman & Frost, 2015; Frost, et al., 2015)
- SL ability in a given domain is a stable trait.
- Statistical learning (SL) is fundamental for first language acquisition.

Variabilities in SL in both auditory and visual domains have been associated with children’s vocabulary, grammar and reading abilities.

Current Study

- How do visual and auditory SL abilities each contribute to individual’s language skills?
- Are SL abilities independent across domains in children?
  - If so, how are SL abilities from different domains associated with children’s language skills?

Stimuli

Visual and tone sequences were designed by concatenating four triplets of images or tones. Foils for the test phase preserved the relative positions of each element in the triplet, but combined them differently (i.e. if ABC, DEF, and GHI were triplets in the familiarization sequence, a valid foil would be AEL).

Visual Statistical Learning (VSL)
Familiarization (Target detection task): Two-forced choice test

Auditory Statistical Learning (ASL)
Familiarization (Target detection task): Two-forced choice test

Expt. 1: Validating the task design
Participants: 15 right-handed adult native English speakers

<table>
<thead>
<tr>
<th>SL Task Performance</th>
<th>Visual</th>
<th>Auditory</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>mean age</td>
<td>M: F</td>
</tr>
<tr>
<td>8</td>
<td>26.7</td>
<td>4:4</td>
</tr>
</tbody>
</table>

Decreased RT across trials:
- VSL: 1.7 = -3.064, p = 0.0026
- ASL: 1.7 = 1.05, n.s.

Accuracy:
- VSL: structured (0.89) > random (0.44) (p = 0.0013)
- ASL: structured (0.72) > random (0.53) (p = 0.0039)

Expt. 2: SL and language skills in adults
Participants: 33 right-handed adult native English speakers, mean age: 24.2 years old, 10 males and 23 females.

Standardized Assessments: IQ: KBIT-II; Sentence comprehension: WJ-III NU ACH Reading Fluency; Passage comprehension: WRMT™.III.

SL Task Performance

Decreased RT across trials:
- VSL: z = -3.326, p = 0.001
- ASL: n.s.

Accuracy:
- VSL: structured (0.78) > random (0.54) (p = 0.001)
- ASL: 0.69 > 0.5 (p = 0.001)
- VSL > ASL (p = 0.017)

Expt. 3: SL and language skills in children
Participants: 23 right-handed native English-speaking children (8-16 years old). Mean age = 11.3 years. 11 males and 12 females.

Standardized Assessments: IQ: KBIT-II nonverbal; Syntax: TROG-2; Reading: TOWRE; Sentence Comprehension: WJ-III NU ACH Reading Fluency

SL Task Performance

Decreased RT across trials:
- VSL: z = -2.51, p = 0.012
- ASL: n.s.

Accuracy:
- VSL: 0.68 (>0.5, p < 0.001)
- ASL: 0.64 (> 0.5, p < 0.001)
- VSL vs. ASL: no difference (p > 0.64)

Conclusion

- Across tasks and age groups, statistical learning performance is significantly above chance.
- Response time during learning is a sensitive measure for statistical learning abilities.
- Test accuracy in auditory and visual SL is not correlated. However, there is response time evidence for shared mechanisms during online learning.
- ASL and VSL performance is related to individual language skills, independent of general intelligence.
- Further neuroimaging studies may reveal important differences between tasks and age groups.

Reference:
2. Evans et al., J Speech Lang Hear Res., 2009