Main research questions
1. Does accuracy of repetition of distinctive features vary as a function of natural class for children with and without hearing loss?
2. How do children with and without hearing loss perform on a standardized speech production measure (the GFTA/II)?
3. Which subject attributes are the strongest predictors of performance on linguistic features?

Background
Lexical status Lexical neighborhood relationships differ between real words and nonwords.

Age
An older child’s lexicon may be different in a number of respects that have been shown to affect accuracy (e.g., robustness of representations, fluency, number of lexical items and associated neighborhood words. Stelmachowicz, Pittman, Hoover, Lewis, & Beckman, 2002; Edwards, Beckman, & Munson, 2004; Munson, Edwards, & Beckman, 2005).

Distinctive features (natural classes) known to improve with age.
- Hearing loss (i.e., audibility) affects the lexicon:
  - The lexicon may develop slower in children with HL (Davis, Morrison, van Kampen, & Wanner-Cooz, 2000; Emmert & Stark, 1995).
  - Lexical competition may reduce lexical access ability (Jerger, Lal, & Marchand, 2002).
- Nonword repetition and phonological awareness performance may be decreased (Brusco, Bishop, & Norbury, 2001; Moller, Tuntury, Yoningsaine-Iamo, Connor, & Jerger, 2007).
- Manner characteristics associated with fricatives and affricates (noise > 3 kHz) may be inconsistently audible to children with HL (Dehnhard, Plutet, Koolstra, & Inks, 2005; Lutti, McGarr, & Gaffe, 1987).

Procedure
- All stimuli randomized as part of computer game with participants.
- Stimuli played in open style, natural production, adult female voice.
- Children with HL all wore amplification during testing.

Data analysis, Bayesian logistic regression model
- Dependent variable
  - 1. distinctive feature reproduction accuracy
  - Independent variables in the model
    1. Lexical status (word vs. nonword)
    2. Age (4 yrs, 7 yrs)
    3. Hearing status (HL, NH)
    4. Productive phonology (GFTA standard score)
    5. Expressive vocabulary (EVT standard score)
    6. Stimulus feature values
      - Voice (voiceless, voiced)
      - Manner (stop, fricative/affricate)
      - Place (labial, alveolar, velar)

Results
1. There is a bias toward voicing responses. Voiced stimuli are more likely to be produced as voiced than voiceless.
2. There is a bias toward stop responses. Fricative/affricate responses are more likely to be produced as stop than vice versa.
3. There is a bias with respect to place.
4. The manifest bias is larger than the voicing bias, as reflected in the relative magnitudes of voice and place parameters.
5. The fricative/affricate manner class is more variable and inaccurate, perhaps reflecting HH kids’ perceptual difficulties, but may also be due to production.
6. Age, lexical status, & GFTA are consistent predictors of accuracy for both HH and NH kids (not too surprising).

Conclusions
1. Voice and manner accuracy varies for both children with and without HL. Place accuracy does not appear to be similarly affected. This is surprising because place distinctions may be especially perceptually challenging in children with HL.
2. The GFTA was a consistent and strong predictor for all DP representation accuracies; HH vocabulary had poorer performance overall.
3. Manner GFTA appeared to be the strongest predictors of performance. In particular, fricative/affricate responses were significantly harder for the HH group. This may be due to stopping for the HH group, which is well known in the literature.

Future directions
1. Look at additional independent variables (e.g., age, vocal intensity, overall size (n 4 kHz) may be inconsistently audible to children with HL, and without HL.
2. Look at additional dependent variables (e.g., perception of vowel height, backness, and acoustic similarity to the stimulus may shed light on phonetic convergence and imitation skills in children with and without HL).
3. Further research with respect to real objects may shed light on phonemes in children with and without HL.
4. Children may be able to identify the differences in real objects, and the data may be different due to real objects.