Developmental Changes in the Early Childhood Executive Function and Language Relationship: A Preliminary Analysis
Kaitlyn E. May1, Ursula Johnson2, & Janelle Montroy2
1The University of Alabama, 2The University of Texas Health Science Center at Houston

ABSTRACT
Recent studies demonstrate strong, concurrent relationships between language and executive functions (EF), particularly during early childhood. Whereas some studies cite a bidirectional relationship, others suggest that EF is predictive of language gains, while others suggest that it is language which affects EF through conversational practice. Further controversy remains in the literature regarding which components of EF are engaged in language development. The specific direction of this relationship remains unclear. Recent behavioral studies cite strong, concurrent relationships between EF and language, whereas some studies suggest that EF is predictive of language gains. The detailed age trajectory of oral vocabulary knowledge: Differences by class and race. Sociol Res Q 2004; 65(4):295–314. doi:10.1037/0038-0145.295.3.295

INTRODUCTION
EF and language develop rapidly during early childhood in a dynamic, iterative process (Farkas & Beron, 2004; Vygotsky & Kozulin, 2012). Recent behavioral studies cite strong, concurrent relationships between language and EF, particularly during early childhood (Gooch et al., 2016). The specific direction of this relationship remains unclear. Multiple studies cite a bidirectional relationship between the two constructs (Slot & Suchdolitz, 2018). Other studies suggest that EF is predictive of language gains (Fabs et al., 2014). Other research suggest that it is language which affects EF through conversational practice (Gooch et al., 2016). In addition, controversy remains in the literature regarding which components of EF are engaged in language processes.

METHODS
EF and language are best fitted by a curvilinear relationship. Thus, in order to further specify the relationship between EF and language, we employed linear statistical analyses to examine the relationship of the two constructs. This is compounded by the fact that a large number of these studies have employed linear statistical analyses to examine the relationship of the two constructs. Thus, in order to further specify the relationship between EF and language, we employed linear statistical analyses to examine the relationship of the two constructs.

RESULTS
Curvilinear regressions were conducted to assess the relationship between Snack Delay scores and each of the language measures. After evaluating a linear model, each additional step involved entering the next highest power of the predictor (Snack Delay scores). This continued until the addition of the next highest power increased the fit of the model to the data by an insignificant or otherwise small amount. Table 2: Predicting ECI Performance from Snack Delay Scores

<table>
<thead>
<tr>
<th>Step</th>
<th>dR²</th>
<th>F for dR²</th>
<th>df</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: Linear</td>
<td>0.066</td>
<td>1.147</td>
<td>.039</td>
<td></td>
</tr>
<tr>
<td>2: Quadratic</td>
<td>0.776</td>
<td>2.147</td>
<td>.225</td>
<td></td>
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<td>3: Cubic</td>
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<td>3.147</td>
<td>.004</td>
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</tbody>
</table>

Table 2: Predicting CDI Performance from Snack Delay Scores

<table>
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<th>F for dR²</th>
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<tbody>
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<td>3: Cubic</td>
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<td>3.101</td>
<td>.018</td>
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</tbody>
</table>

DISCUSSION
• Relationship between inhibitory control and language may be best fitted by a curvilinear model, and perhaps the curvilinear relationship reflects the lack of consensus in studies employing linear models.
• Results demonstrate a cubic relationship between Snack Delay scores and language, as measured by the PLS-5. This is in line with existing studies pointing to a relationship between receptive language skills and nonverbal inhibitory control via linear regression models (Kaushansky et al., 2017).
• Results demonstrate a quadratic relationship between Snack Delay scores and communicative performance (ECI). This reflects existing research demonstrating that EF serves the mental lexicon to achieve correct word choice for a given communicative context and task, while inhibiting production of the inappropriate word (Ye & Zhou, 2009).
• Results indicate a cubic relationship between Snack Delay scores and expressive language (MB-CDI). The results align well with studies demonstrating significant relationships between inhibitory control, word production, and internal state vocabulary during this age group (Bollmann et al., 2015).

IMPLICATIONS
• Understanding the relationship between EF and language throughout development will provide insight into the potential importance of developing language curriculums which strengthen domain-general skills, like EF, within a process-specific framework in order to enhance domain-specific skills, like language.
• Early childhood education curriculum may need to be critical of task demands and consider that results may differ when minimizing executive and attentional demands of language tasks.
• Language intervention strategies that focus on building EF skills within linguistic tasks may be of particular importance to special populations and the remediation strategies that are used to serve these populations.

REFERENCES