

## Effects of English versus Spanish Exposure on Multisensory Attention Skills From 3-36 Months of Age

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### Background

Multisensory attention skills (MASks) including sustaining attention, shifting/disengaging attention, and intersensory matching of synchronous sights and sounds, are foundational for language development (Bahrick et al., 2020). However, developmental trajectories of MASks and pathways to outcomes remain unclear. Two new individual difference measures for young children can address these questions. The Multisensory Attention Assessment Protocol (MAAP; Bahrick et al., 2018a) measures all three MASks and the Intersensory Processing Efficiency Protocol (IPEP; Bahrick et al., 2018b) is a more fine-grained measure of just intersensory matching (i.e., audiovisual synchrony detection). Both assess attention to audiovisual social (women speaking English) and nonsocial (objects dropping) events, and the MAAP has been shown to predict language outcomes (Bahrick et al., 2018a).

Many U.S. children (33%; US Census 2016) come from homes in which a second language (e.g., Spanish) is spoken part of the time. Given the increasing use of the MAAP and IPEP, it is essential to determine the effectiveness of these protocols for children who have differential exposure to English. Although both protocols assess basic attention skills not requiring language, the social events depict women telling stories in English. Might children from predominantly English-speaking homes have an advantage in attending to the social (but not nonsocial/object) events? Here, we examined relations between basic MASks to social events on the MAAP and IPEP and exposure to English across 3 to 36 months of age.

### Method

Children (N=103) participating in a longitudinal study received the MAAP and IPEP at 3, 6, 12, 18, 24, and 36 months. On the MAAP, a 3 s central stimulus (geometric animation) was followed by two 12 s side-by-side lateral events of women speaking, one of whom was synchronous with her appropriate soundtrack (for an example video, click [here](#)). Three measures were derived: intersensory matching of faces and voices, sustained attention to faces, and speed of shifting/disengaging from the central event to faces. On the IPEP, a 2x3 grid of six women speaking was shown on each trial and only one of the women was synchronous with her appropriate soundtrack (for an example video, click [here](#)). Three measures were derived: intersensory matching of faces and voices, frequency of fixating the speaking face, and speed to fixate the speaking face.

At each age, parents also reported the percentage of time (on a scale of 0 – 100) of child directed speech their children were exposed to in English versus Spanish.

### Results

We conducted structural equation models to assess relations between exposure to English and MASks at all ages. Since the MAAP and IPEP assess basic attention skills not requiring language, we first tested the null hypothesis that English exposure has no effect on MASks. We assessed the fit of null models in which all paths from English exposure to MASks were constrained to 0. If the null model fit is good, we can accept the null hypothesis that there is no relation between English exposure and MASks. If null model fit was poor, we next assessed the

fit of freely estimated models which can identify instances in which English exposure significantly predicted MASk performance. If the null model fit is poor but the freely estimated model fit is good, we can accept the hypothesis that there is a relation between English exposure and MASks. Finally, we assessed differences between model fit for the null and freely estimated models using a chi-square difference test.

Null models showed excellent fit for 34 out of 36 model pathways (94%; 6 MASks x 6 ages). At each age, there was no effect of English exposure on intersensory matching of faces and voices, sustained attention to faces, and speed of shifting/disengaging to faces on the MAAP, as well as no effect for frequency and speed of fixating the speaking face on the IPEP,  $\chi^2s < 8.94$ ,  $ps > .18$ . However, for intersensory matching of faces and voices on the IPEP, the null models showed poor fit at two ages (3 and 12 months). In these two instances, freely estimated model fit was good, and it was significantly better than the fit of the null model,  $\chi^2s > 12.87$ ,  $ps < .04$ . At 3 and 12 months, surprisingly, results indicated that less English exposure (i.e., more Spanish exposure) was associated with better intersensory matching of faces and voices.

## Discussion

Findings demonstrate little relation between English language exposure and performance of 3-36-month old children on tests of basic MASks (sustaining attention, shifting/disengaging, or matching sights and sounds) for audiovisual speech events on the MAAP or IPEP. We failed to reject the null hypothesis in 94% of tests conducted. When we did find significant relations between English exposure and MASks (6%), findings were in the direction opposite our predictions. For children at 3- and 12-months of age, less English exposure was associated with better face-voice matching. In sum, for dual language learners between 3 and 36 months of age, greater English language exposure does not provide any advantage for performance on the basic multisensory attention skills measures by the MAAP and IPEP.