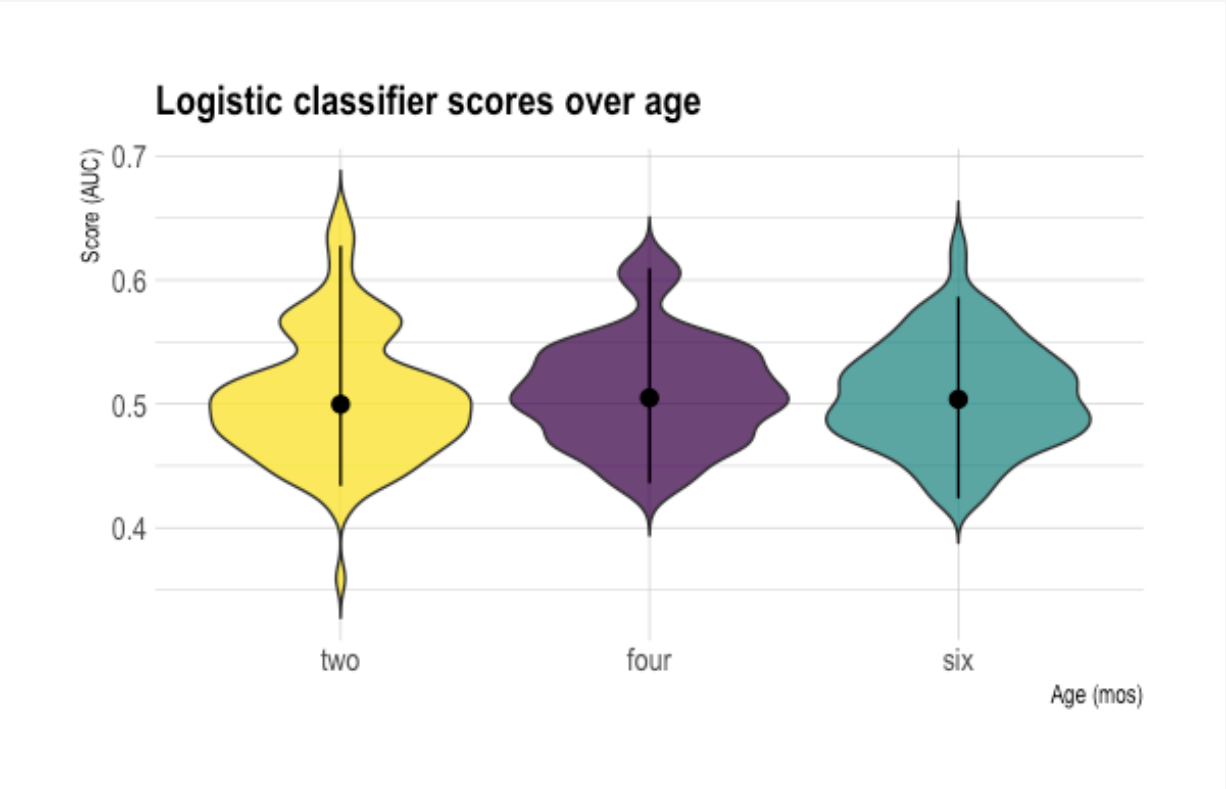
Results

Table 1. Sample demographics

		Age (mo)	Age (days)	Birth weight (oz)	Head size (cm)	SES	Maternal Edu	Paternal Edu
Mean	six	191.75	116.63	43.75	52.54	16.50	16.42
	four	124.88	127.00	42.29	46.00	15.76	15.47
	two	59.45	119.26	39.48	53.03	16.52	16.13
Standard deviation	six	7.02	11.38	1.33	11.86	1.87	2.65
	four	11.98	11.54	1.36	15.19	2.37	3.33
	two	5.92	13.15	1.07	11.65	1.83	2.78
Skewness	six	0.62	-0.42	0.25	-0.83	-0.75	-0.12
	four	0.56	-0.45	-0.82	-0.15	-0.04	0.77
	two	0.20	0.15	0.36	-0.88	-0.63	-0.15
Std. error skewness	six	0.11	0.11	0.11	0.11	0.11	0.11
	four	0.13	0.13	0.13	0.13	0.13	0.13
	two	0.10	0.10	0.10	0.10	0.10	0.10
25th percentile	six	188.00	110.50	43.00	42.75	16.00	15.00
	four	115.00	117.00	42.00	40.50	14.00	12.00
	two	54.00	111.00	39.00	43.00	16.00	14.00
50th percentile	six	189.50	115.00	44.00	56.50	17.00	16.50
	four	122.00	133.00	43.00	43.00	16.00	15.00
	two	59.00	115.00	39.00	57.00	17.00	16.00
75th percentile	six	197.00	124.00	44.25	61.25	17.25	18.00
	four	135.00	137.00	43.00	61.00	17.00	18.00
	two	64.00	127.00	40.00	62.00	18.00	18.00

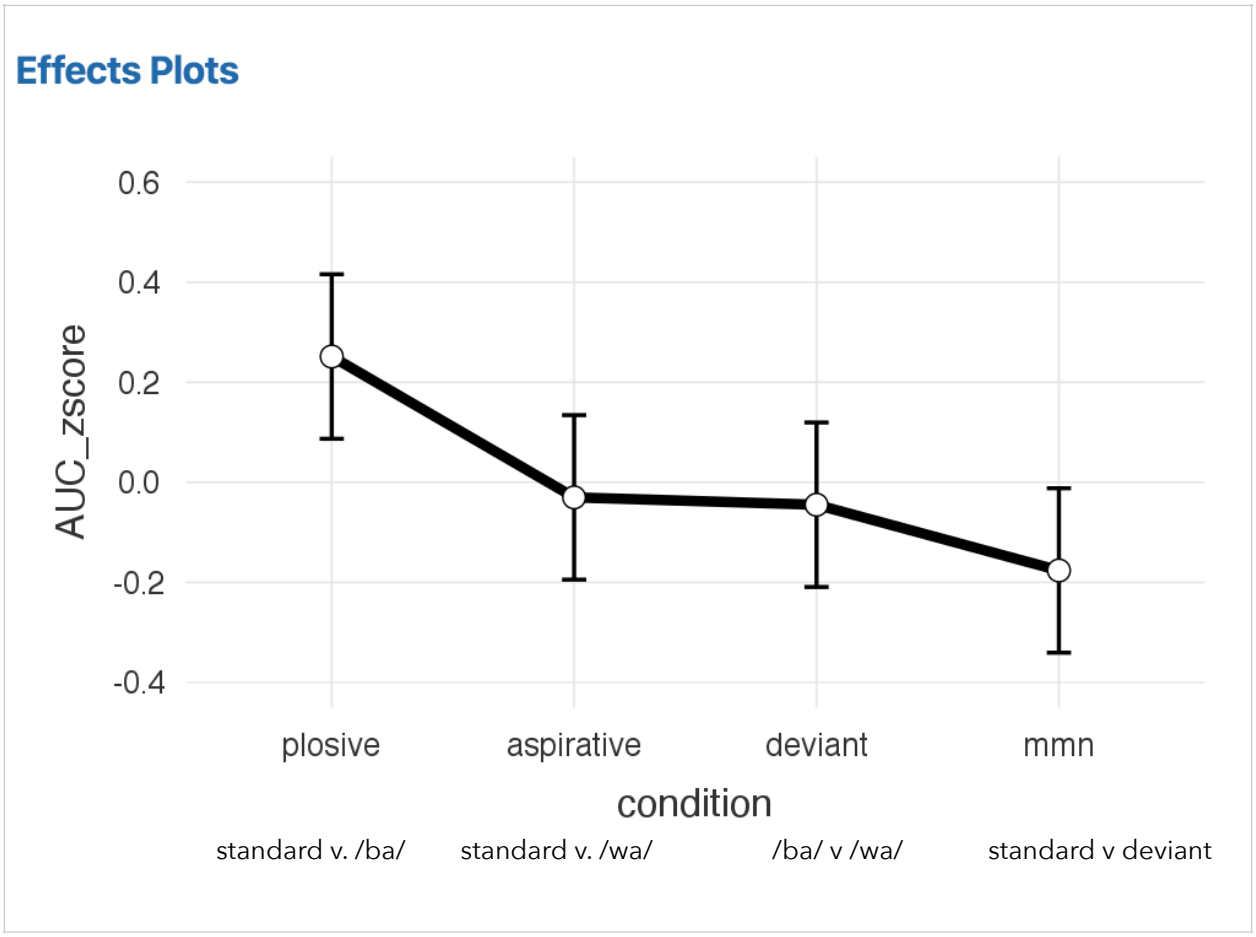
Sample demographic data for N=72 infants with associated Hollingshead SES data and completed CDI language outcomes between 18-30 months-age. Families were predominately made-up of dyads consisting of White-Non Hispanic Latino mothers (61.1%) and fathers (79.2%), and respectively, 91.7% and 79.2% of parents had at least a high-school level-education or equivalent.

Figure1. MEG event classification scores



Distribution of logistic classifer scores (AUC) over age. We argue that the change in distributions is a signature of perceptual narrowing associated with early phonological learning. Meaning that with age, as infants learn their native speech sounds, auditory evoked discriminatory (MMN) activity in response to VOT contrasts (/ba/, /wa/) approaches a relatively more normal pattern by 6-months of age. Here we show that the patterning of AUC scores captures increasing MMN reliability with age.

Figure2. Estimated marginal mean AUC values by condition



Post Hoc Comparisons

			Difference	SE	t	df	$p_{bonferroni}$
plosive	-	mmn	0.43	0.06	7.36	1362.18	< .001
plosive	-	aspirative	0.28	0.06	4.84	1362.18	< .001
plosive	-	deviant	0.30	0.06	5.10	1362.18	< .001
aspirative	-	mmn	0.15	0.06	2.51	1362.18	0.031
aspirative	-	deviant	0.01	0.06	0.25	1362.18	0.796
deviant	-	mmn	0.13	0.06	2.26	1362.18	**0.042**

Plot of EMMs from linear mixed model of AUC scores. Fixed intercept mixed effects ANOVA of AUC data revealed a significant effect of condition (plosive: standard vs. /ba/, aspirative: standard vs. /wa/, deviant: /ba/ vs. /wa/, mmn:standard vs. deviants). Omnibus tests resulted in a fit of ($F_{(3, 1365.0)}$=19.18, *P*<.001, R^2=0.4). Pairwise post-hoc comparison of cell means indicated significant (critical?) difference between deviant and mmn conditions.

Table 2 Fixed Effect Omnibus ANOVA

	F	Num df	Den df	p
Condition	19.62	3	1350.53	**< .001**
Age	0.55	1	153.39	0.458
SES	0.74	1	341.57	0.392
Age group	3.22	2	79.19	**0.045**
Gender	4.01	1	109.37	**0.048**
Head size	5.92	1	199.35	**0.016**
Birth weight	2.54	1	122.51	0.114
Condtion ✻ Age	20.61	3	1350.53	**< .001**

Fixed Effects Parameter Estimates

			95% Confidence Interval				
Effect	**Estimate**	**SE**	**Lower**	**Upper**	**df**	**t**	**p**
(Intercept)	-3.25	1.53	-6.24	-0.26	60.33	-2.13	0.037
plosive - aspirative	0.44	0.13	0.19	0.70	1354.22	3.40	**< .001**
aspirative - deviant	-0.60	0.13	-0.85	-0.34	1354.22	-4.59	**< .001**
deviant - mmn	1.04	0.13	0.78	1.29	1354.22	7.98	**< .001**
age	0.03	0.01	0.00	0.05	60.28	2.15	0.035
ses	0.00	0.01	-0.01	0.01	62.62	-0.26	0.795
four - (six)	1.41	0.91	-0.38	3.20	58.51	1.54	0.128
two - (six, four)	1.95	1.22	-0.45	4.35	59.59	1.60	0.116
boy - (girl)	0.10	0.17	-0.23	0.42	63.36	0.59	0.558
headSize	-0.17	0.08	-0.33	-0.02	60.52	-2.22	**0.030**
birthWeight	0.02	0.01	0.00	0.03	62.95	2.66	0.010
plosive - aspirative ✻ age	0.00	9.82E-04	0.00	5.72E-04	1354.22	-1.38	0.169
aspirative - deviant ✻ age	0.01	9.82E-04	0.00	0.01	1354.22	5.23	**< .001**
deviant - mmn ✻ age	-0.01	9.82E-04	-0.01	-0.01	1354.22	-7.76	**< .001**

Mixed linear modeling was done to assess the additive effect of age on classification scores (AUC). Table shows the fixed intercept model results and ANOVA tests with Satterthwaite Df estimation for fixed terms: AGE GROUP (two, four, six); GENDER (boy, girl) and covariates: SES, AGE, HEAD SIZE, & BIRTH WEIGHT. Omnibus tests confirmed main effect of CONDITION, and also revealed main effects of HEAD SIZE and CONDITION * AGE interactions

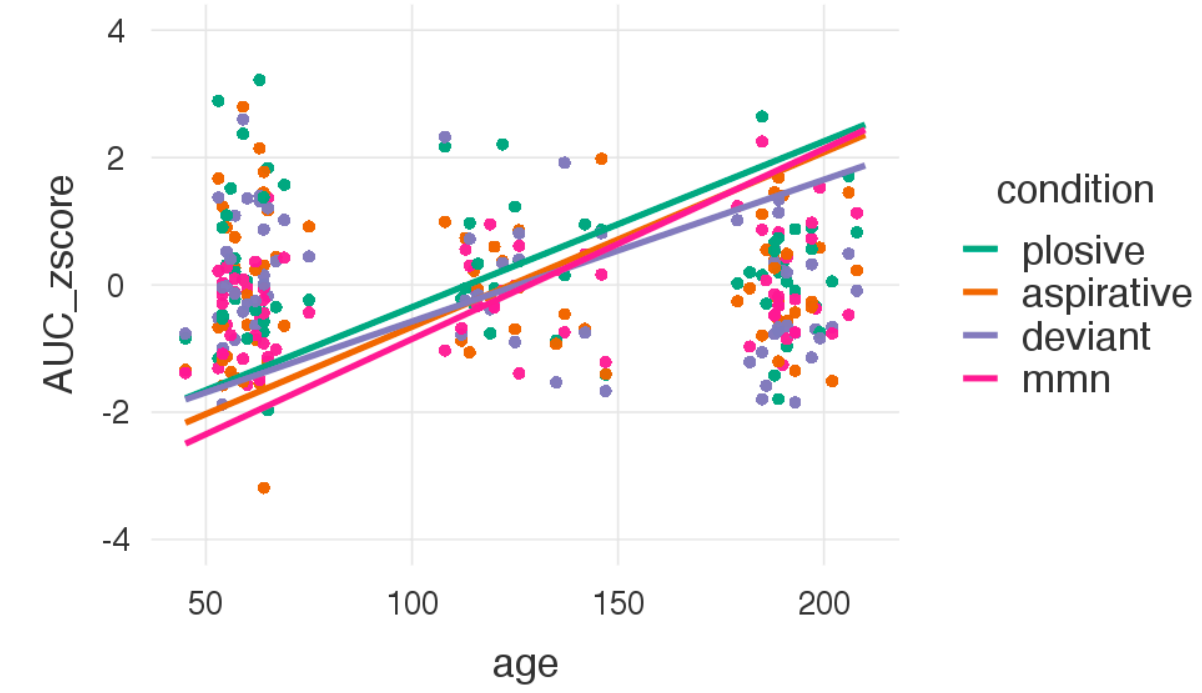
Model estimates and post-hoc simple contrasts between CONDITION levels (plosive, aspirative, deviant, mmn) indicated that (critically?) the difference between deviant and mmn AUC scores is significantly affected by AGE (β=-0.01, $t_{-7.76}$=2.15, p<0.001).

Simple effects of condition : Parameter estimates

	Moderator levels				95% Confidence Interval				
Age (mos)	Age (days)	Post-Hoc Contrast	Estimate	SE	Lower	Upper	df	t	p
Two	M-1·SD=60.977	plosive - aspirative	0.36	0.08	0.20	0.52	1354	4.47	**< .001**
		aspirative - deviant	-0.28	0.08	-0.44	-0.13	1354	-3.52	**< .001**
		deviant - mmn	0.57	0.08	0.42	0.73	1354	7.12	**< .001**
Four	M=119	plosive - aspirative	0.28	0.06	0.17	0.39	1354	4.94	< .001
		aspirative - deviant	0.01	0.06	-0.10	0.13	1354	0.26	0.796
		deviant - mmn	0.13	0.06	0.02	0.24	1354	2.31	0.021
Six	M+1·SD=177.023	plosive - aspirative	0.20	0.08	0.05	0.36	1354	2.52	**0.012**
		aspirative - deviant	0.31	0.08	0.15	0.47	1354	3.88	**< .001**
		deviant - mmn	-0.31	0.08	-0.47	-0.15	1354	-3.85	**< .001**

Note. Simple effects are estimated keeping constant other independent variable(s) in the model

Figure 3. Modulation of AUC by age and classification condition



This plot illustrates the trajectory of AUC scores between approximately 2- and 6-months age. With increasing age (days) we observed a significant overall increase in AUC (β=0.03, 0-0.05 95%CI, $t_{60.28}$=2.15, p=0.035). However, this effect was modulated by conditioning of oddball stimuli for the logistic classifier to distinguish between ERF events. Model indicates that with age the contrast difference between mmn (standard vs. deviant) and deviant (/ba/ vs. /wa/) conditions is a significant component. Whether the estimated coeff is a magnitude of difference at different ages or the rate of change with age is TBD.