Published in final edited form as:
J Child Lang. 2013 June ; 40(3): 605–627. doi:10.1017/S0305000912000177.

Effect of Foster Care on Language Learning at 8 Years: Findings from the Bucharest Early Intervention Project

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Abstract

School-age language outcomes for children in a longitudinal, randomized controlled study of foster care were examined. Even though children had different placement status at 8 years, children originally placed in Romanian foster care had higher sentence repetition accuracy and longer sentences at 8 years than children who originally lived in severely depriving institutional care. A larger number of foster children also showed written word identification ability. Children placed in foster care by 25 months had significant advantages in nonword repetition and word identification than children placed later. Children placed by 15 months performed equivalently to typical community peers on these measures. Children's expressive language at 42 months was correlated with their 8-year sentence repetition, nonword repetition, and word identification. The results speak to the continuing adverse effects of early poor institutional care on later language development and to the key importance of age of placement in a more optimal environment.

Language outcomes for children raised in sub-optimal institutional care are receiving increasing attention because of the significant window this population provides on the effects of early experience on development. International adoption of children living in institutional care in several countries also is growing, presenting new challenges in assessment and intervention for children's language skills. Overall, positive short and long term language outcomes have been reported for many young children living in institutional care who subsequently have been placed in foster and adoptive families as infants and young toddlers (Cohen, Lojkasek, Zadeh, Pugliese, & Kiefer, 2008, Snedeker, Geren, & Shafto, 2007). However, the outcomes are more mixed for children who have experienced

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institutional care and are placed in foster or adoptive care later in life. While long-term positive outcomes have been reported for both spoken and written language (Scott, Roberts, & Krakow, 2008); there are several studies indicating that a larger number of internationally adopted children than their peers continue to show language and other difficulties during the school years (Behen, 2008; Beverly, McGuinness, & Blanton, 2008; Loman, Wiik, Frenn, Pollak, & Gunnar, 2009).

This paper reports on school-age language outcomes from the first randomized controlled trial of institutional and foster care, the Bucharest Early Intervention Project (BEIP, Zeanah et al., 2003). Historically, Romanian institutions have presented an instance of a very physically and socially depriving care environment. The BEIP is a longitudinal examination of development, following children living in Romanian institutions who were assigned to foster care or to continued institutional care. The randomized design is a unique strength of the study, controlling for selection biases inherent in previous research. Unlike studies of international adoption, the within-country foster placement also allows for examination of the children's development in their native language and cultural context.

We have previously addressed two main issues in examining the children's early language outcomes, whether foster care intervention facilitates language development, and if so, whether the timing of placement influences outcomes. Issues of timing and potential sensitive periods in language development have been found to be relevant in several populations in which exposure to a first or second spoken language occurs some time after birth, including deaf children who receive cochlear implants at early and later ages, sequential bilingual children, and adults who are second language learners (see Werker & Tees, 2005 for review). In these populations, the later language exposure leads to an observable difference in language outcomes beyond the gradual change that is associated with age, aligning well with the concept of a sensitive period(s) (Hakuta, Bialystok, & Wiley, 2003).

Poor institutional care in early development, in which language and social input is very limited, also may have this type of threshold influence on language development, in which language recovery is much more or less likely after a particular point in development. As part of the English and Romanian Adoptees study (ERA), Croft et al. (2007) studied school-age English language test outcomes for young Romanian children in institutional care who were adopted into the UK. In assessments of the children's spoken language at 6 years and reading comprehension at 11 years of age, few negative effects were found for the group of children who had experienced less than 6 months of institutional care. Children with less than 6 months of institutional care did show somewhat poorer reading comprehension at 11 years than children who had not experienced institutional care, but they were still within age expectations. However, children who had lived in institutional care for longer than 6 months showed very substantial language deficits. Further, there was no correlation between duration of institutional care and language outcomes within this group of children. Thus, the time at which children were placed in a less depriving environment was a critical factor in their later language outcomes.

We have reported early BEIP expressive and receptive language outcomes at 30 and 42 months of age (Windsor, Benigno, Wing, Carroll, Koga, Nelson, Fox, & Zeanah, 2011; Windsor, Glaze, Koga, & The Bucharest Early Intervention Project Core Group, 2007). In these early assessments, there is a clear positive intervention effect of early foster care placement. On formal language tests and in their spontaneous conversation at both assessment points, children placed by 24 months of age showed significantly stronger Romanian language outcomes than children who remained in institutional care. Similar to Croft et al.'s (2007) finding of the advantage of short institutional duration, children placed in foster care by 15 months had equivalent language skills to typically developing peers living with their biological families in the same communities. On the other hand, while they too continued to learn language, children who were placed in foster care after 24 months had the same severe language delays as children who remained in institutional care. Moreover, the language at 30 months of children placed in foster care was highly predictive of their 42-month outcomes, confirming the importance of early language achievement.

This differential effect of early versus later foster care placement was mirrored in the children's broader cognitive skills (Nelson, Zeanah, Fox, Marshall, Smyke, & Guthrie, 2007). The difference in language outcomes before and after the placement age of 24 months was particularly compelling. However, unlike Croft et al.'s (2007) results for older children, there was a more graded effect of placement age for these young children, with a robust correlation between placement age and language outcomes.

The differences in study design, ages of interest, and language assessments in the BEIP and ERA cohorts make direct comparisons difficult. However, it is intriguing to examine the stability of BEIP language outcomes four and a half years after the 42-month assessment. We were interested in determining whether the positive intervention effect of BEIP foster care was still evident, whether early language performance would predicts language skills during the elementary school years, and whether foster placement age showed the same effects as at earlier ages.

The BEIP uses a conservative 'intent to treat' approach in which group analyses are based on the children's original assignment to either foster care or continued institutional care, regardless of the current placement status. At the earlier language assessments at 30 and 42 months of age, almost all children were in the groups to which they had been assigned originally. At the current 8-year assessment, the children were living in a range of care environments, including continuing institutional or foster care or placement with biological or adoptive families. Recently, Fox, Almas, Degnan, Nelson, and Zeanah (2011) showed that BEIP foster care continued to have a significant effect on children's IQ at 8 years of age, with this effect especially evident for children who remained in this foster care at 8 years. There also were moderate effects of timing, with children placed in foster care after 26 months of age more likely to have very low IQ profiles than children placed earlier.

As in Fox et al. (2011), examination at 8 years of age allowed us to assess any systematic influence of children's later care environments on language development beyond the expected impact of early severe deprivation. For children who have not experienced early severe deprivation, quality of the care environment and type of language input during the

preschool years has been found to have at least modest effects on children's current and later language ability. For example, preschoolers' syntactic growth and the proportion of complex sentences that teachers use has been found to be correlated beyond the potentially mediating effect of socioeconomic status (Huttenlocher, Vasilyeva, Cymerman, & Levine, 2002). Similarly, kindergarteners' receptive vocabulary and quality of their preschool classrooms appears to be correlated (Peisner-Feinberg et al., 2000). Intervention by speech-language pathologists also has been found to have positive effects on some expressive language skills for young children with language delays (Law, Garrett, & Nye, 2004).

Assessment of the children's language at 8 years provided a significant opportunity to examine the long-term effects of early institutional care and the effects of original and current placement status on language development. Given the robust effects of early experience on the children's pre-school language development, we anticipated that both children's original group assignment and foster placement age would continue to impact their language performance at 8 years.

Method

Participants

A total of 105 children in the BEIP cohort had language data available at the 8-year assessment and participated in the current study. These children originally were randomized either to a foster care group (FG, *N* = 54, 29 male) or to continued institutional care (IG, *N* = 51, 26 male). Children with medical conditions were not included in either group. At the 8-year assessment, IG children had a mean age of 8;8 (*SD* = 0;5) and FG children had a mean age of 8;6 (*SD* = 0;7). The average age of placement for children in the FG group was 23 months (*SD* = 0;7). The institutional care the children received was characterized by impoverished stimulation, structured routines, and a very low caregiver-child ratio. High quality foster placements, that would not otherwise have been available, were achieved for the FG children through collaboration with Romanian agencies (see Zeanah et al., 2003 for details). There was systematic contact and support available for families through BEIP foster care placement.

The BEIP intervention formally ended at 54 months of age, and local agencies assumed responsibility for the foster care network. At the 8-year assessment, only 11 IG children (7 male) retained their original IG group assignment as their current placement status. Of the remaining IG children, 16 were in government foster care (8 male), and 24 (11 male) had another care environment as their current placement status: reintegrated with their biological families, adopted or placed with a family, or living in an apartment. Twenty-six FG children (13 male) remained in BEIP foster care at 8 years, 6 were in government foster care (1 male), and 22 (15 male) had another care environment as their current status.

In addition to the IG and FG children, typically developing age peers who had never received institutional care participated as a comparison group (NIG, *N* = 37, 15 male). These children had a mean age of 8;5 (*SD* = 0;3) and all had participated in the NIG comparison group at the 42-month assessment. The children lived with their biological families and were recruited through pediatric clinics in Bucharest. There were an additional 61 typically

developing children who were peer interactants in one or more of the spontaneous language samples obtained in the study (*M* age = 8;5, *SD* = 0;4). These children did not participate at earlier assessments and data are not reported on these children in this study.

Materials and Procedures

There are no standardized tests of language or reading for Romanian-speaking children. Psycholinguistic tasks, however, have been found to separate children with and without language impairments in several different languages and were used as part of the language assessments at 8 years. While performance on these types of tasks often is used to make inferences about different underlying mechanisms for language, our main interest here was the utility of the tasks as clinical markers of language performance (Conti-Ramsden, Botting, & Faragher, 2001; Stokes, Wong, Fletcher, & Leonard, 2006).

There were four expressive language measures administered in Romanian by trained research personnel. These included nonword repetition, sentence repetition, written word identification, and average utterance length from a spontaneous language sample. Each of the three elicited tasks included practice/trial items in addition to the test items. All tasks and stimuli were developed and scored in conjunction with native Romanian-speaking informants.

Nonword repetition—Children's nonword repetition (NonRep) accuracy traditionally has been considered a marker of phonological working memory (Gathecole & Baddeley, 1989). However, a range of encoding and articulatory factors related to word learning appear to influence performance (Graf-Estes, Evans, & Else-Quest, 2007). Our nonword repetition task included 1- to 4-syllable nonsense words, with 10 test words at each syllable length (Appendix A, Table A1). A variety of syllable shapes was included at each syllable length, with all syllable shapes found in Romanian (Dinu & Dinu, 2006). No syllable carried any lexical meaning in Romanian. Words were presented from shortest to longest syllable lengths, and children were given one opportunity to repeat each word. Respectively, there were 34, 53, 69, and 90 phonemes in the one-, two-, three, and four-syllable words, for a total of 246 phonemes. The task was scored conventionally for the percent of phonemes repeated correctly.

Sentence repetition—Immediate sentence repetition (SentRep) accuracy has been considered a function of phonological working memory and morphosyntactic knowledge (Chiat & Roy, 2008; Devescovi & Caselli, 2007). Children repeated 32 spoken sentences in the sentence repetition task, including declarative, negative, question, and passive forms (Appendix A, Table A2). Scoring followed the Clinical Evaluation of Language Fundamentals-4 (Semel, Wiig, & Secord, 2003) in which 3 points was awarded for each sentence repeated exactly, 2 points for 1 error, 1 point for 2 to 3 errors, and 0 points for 4 or more errors. Thus, the total number of points possible was 96. Errors typically were word or phrase omissions or word substitutions.

Word identification—Romanian has a shallow orthography, with graphemes largely corresponding in a transparent way to phonemes. Children in Romania begin elementary

education at 6 or 7 years old, and single written word identification (WI) was considered most useful as a measure of reading for study participants at this 8-year assessment. Children read aloud 50 single printed words in this task (Appendix A, Table A3). Stimulus items included a variety of word classes and were presented with three to four words on each page of a booklet. Words were presented in a general order of decreasing familiarity. English word frequency counts from Carroll, Davies, and Richman (1971) were used as a general guide in parallel with the native Romanian informants' knowledge. Following the Woodcock-Johnson III Tests of Cognitive Abilities (Woodcock, McGrew, and Mater, 2001); a ceiling rule was used in administration and scoring. If a child was not able to correctly and fluently produce all words on two consecutive booklet pages (i.e., 7 to 8 words), the task was discontinued and the score calculated assuming the child could not read the remaining words.

Mean length of utterance—A language sample was obtained from a longer set of semi-structured interactions each IG and FG child had with a typically developing child who had never received institutional care. The 98 typically developing children included the 37 NIG children who served as the primary comparison group. Children sat at a table and were instructed by an examiner to talk with each other for 5 minutes to identify three favorite activities and then to report these back to the examiner. The examiner left the two children alone during the 5 minutes. All interactions were audio- and video-recorded on DVDs. Mean length of utterance (MLU) conventionally is seen as a global marker of expressive language productivity and morphosyntactic skill. MLU was calculated in morphemes by a native Romanian speaker following Devescovi et al.'s (2005) procedure for highly inflected languages. In this calculation, adverbs, conjunctions, and interjections were counted as one morpheme. For other word classes an unmarked form was identified, which was counted as one morpheme. Morphemes were added for changes in definiteness, person, plurality, and case from the unmarked form (see Windsor et al., 2011 for details).

Language at 42 months—As a predictor of children's language performance at 8 years, we used their expressive percentage scores on the adaptation of the Reynell Developmental Language Scales (RDLS, Edwards et al., 1997) at 42 months, reported by Windsor et al. (2011). RDLS scores were available for 48 IG, 52 FG, and 36 NIG children.

Results

Preliminary Analysis

The original intent-to-treat IG and FG groups were used to assess the intervention effect of BEIP foster care on language performance and the effect of foster care placement age. The percentage values for NonRep, SentRep, and WI were arc-sine transformed for the statistical analysis. As has been found in other NonRep studies (Graf Estes et al., 2007), there were ceiling effects at shorter syllable lengths and 4-syllable accuracy was used as the dependent variable for this language measure. One IG children produced no utterances during the language sample and was excluded from the calculation of MLU. The DVDs were not able to be transcribed for 4 other IG children and 1 FG child because of poor audio quality. These children also were excluded. The MLU calculations were based on similar sample lengths

for the remaining IG and FG children (IG: $N = 46$, $M = 45.3$ utterances, $SD = 16.9$; FG: $N = 53$, $M = 51.0$ utterances, $SD = 14.0$).

Effect of BEIP Foster Care

Table 1 shows the group performance on each of the four language measures. For descriptive purposes, NIG group performance also is included in the table for the three elicited language tasks. MLU is not given for the NIG group as the children's sentence length may have been influenced by whether the child was interacting with an IG or FG child. Brief segments from an IG and FG child's language samples are given in Tables B1 and B2 as examples.

To determine the effect of BEIP foster care, we first conducted a multivariate linear regression to predict three of the four language measures: NonRep, SentRep, and MLU. Group (IG, FG), current placement status (original IG/FG group, government foster care, other care), chronological age, and gender were used as predictors. A backwards elimination variable procedure was followed, with group ($F(3,92) = 3.22$, $p = .016$) and chronological age ($F(3,92) = 2.77$, $p = .032$) emerging as the only significant predictors in a subsequent MANOVA. Language scores were not standardized for chronological age and it was not unexpected that age might influence the language performance of children in this age range. However, a scatter plot showed that the age effect was due to the performance of three children (1 IG and 2 FG) who were younger than other children, aged below 7;6 at the 8-year assessment. A MANOVA of the regression model showed the effect of age was not significant ($F(4,89) = 1.79$, $p = 0.138$) when these three children were removed. These children were excluded in all further analyses.

A MANOVA (Pillai test) of the regression model with group as the only selected predictor was significant ($F(3,89) = 2.72$, $p = .034$). Post hoc univariate analyses indicated that the FG group had significantly higher SentRep accuracy than the IG group ($t = 2.10$, $p = .039$) and higher MLU ($t = 2.23$, $p = .028$). The group effect was not significant for NonRep.

Word identification was analyzed separately from the other three language measures because several children showed limited letter knowledge and were unable to read any words, receiving zero scores. An ANOVA showed the FG group had significantly higher WI accuracy than the IG group ($F(1,101) = 4.66$, $p = .033$). Reading failure was significantly higher in the IG group (13 of 50 children had zero scores) than in the FG group (6 of 52 had zero scores) ($\chi^2 = 4.07$, $p < .05$). When children with zero scores were excluded, the overall group difference was lower (IG: $M = 59.1\%$, $SD = 23.8\%$; FG: $M = 64.3\%$, $SD = 20.2\%$) and not significant ($F(1,82) = 3.96$, $p = .287$).

Current placement status—For descriptive purposes, Table 2 shows the IG and FG mean language scores for children in their current placement settings, which included their original group placements, in government foster care, and in other placements. As indicated above, a MANOVA showed there was no significant effect of children's current placement status on their overall language performance.

Effect of BEIP Placement Age for the Foster Group

Regression and correlation analyses—To determine the effect of placement age in the FG group, we again conducted a multivariate linear regression to predict NonRep, SentRep, and MLU. Placement age, current placement status (original IG/FG group, government foster care, other care), chronological age, and gender were entered as predictors. A backwards elimination variable procedure again was used, with placement age emerging as the only significant predictor. A MANOVA (Pillai test) of this model was significant ($F(1,46)$, = 2.91, $p = .031$). The univariate analyses showed that placement age had a significant negative effect on NonRep ($t = -2.828$, $p = .007$) but not on SentRep or MLU.

A follow-up Pearson correlation analysis also indicated that there was a significant negative correlation between placement age and NonRep ($r = -.325$, $p = .009$). To confirm the regression result that current placement status did not have a significant effect on FG NonRep performance, a separate correlation analysis was conducted of children in the FG group ($n = 24$) who remained in BEIP foster care at 8 years. There was a similar pattern of children placed earlier having higher NonRep accuracy, although the correlation did not achieve statistical significance with the smaller sample size was ($r = -.268$, $p = .103$).

WI was not included in the MANOVA because several FG children showed zero scores on this measure. However, a Pearson correlation indicated a significant negative correlation between placement age and WI ($r = -.226$, $p = .054$). A similar correlation was evident in the subgroup of FG children who remained in BEIP foster care at 8 years, but this also failed to reach significance with the smaller sample (n = 24, $r = -.203$, $p = .166$).

Foster group children placed before and after 25 months—Given the significant effect of FG placement age for NonRep and WI, we were interested in whether there was a difference in language performance on these tasks for FG children placed by approximately 2 years of age compared to children placed later. Two equally sized subgroups were used for this analysis; children placed by 25 months ($n = 26$) and children placed after 25 months ($n = 26$). Table 3 shows the performance of the two subgroups on all four language measures. For purposes of comparison, the NIG group and IG groups also were included in this analysis. Finally, we compared the performance of FG children placed by 15 months with NIG performance, with this age cutoff of interest at the 42-month assessment. Of the 26 FG children placed before 25 months, only 6 were placed before 15 months, precluding a robust statistical comparison between this subgroup and the NIG group. Descriptive data are provided for this comparison.

An ANOVA with post-hoc comparisons showed there was a significant NonRep difference among groups ($F(3,138) = 9.49$, $p = .009$). FG children placed by 25 months had significantly higher NonRep accuracy than both FG children placed later and the IG group ($p = .040$), with no significant difference in accuracy between the FG children placed later and the IG group. The NIG group had higher accuracy than all other groups ($p = .009$). The children placed before 15 months had a mean NonRep accuracy of 98.4% ($SD = 1.3\%$) which was equivalent to the NIG mean accuracy of 99.1%.

Much the same pattern was found for WI. The overall group effect was significant ($F(3,138) = 9.08$, $p < .001$). The NIG group outperformed the IG group and FG group placed later ($p = .002$) but not the FG group placed earlier. The FG children placed by 25 months had significantly higher accuracy than FG children placed later and the IG group ($p = .013$), with no significant difference between the second two groups. However, excluding the 13 IG, 2 NIG, and 6 FG children (5 placed after 25 months) with zero WI scores showed that the NIG group significantly outperformed all other groups ($F(3,117) = 5.78$, $p = .001$). No FG child placed by 15 months failed WI, and the mean WI score for this subgroup was 70.9% (SD = 16.8%) which approximated the NIG mean score of 73.8%.

Although there was a not a placement age effect, FG children's performance on the other two measures, SentRep and MLU compared to the IG group also was of interest. It was also possible to examine NIG SentRep performance. For SentRep, the NIG group outperformed all other groups ($F(3,138) = 21.17$, $p < .001$). The FG children placed before and after 25 months had equivalent mean scores and there was no significant difference between either of these groups and the IG group. FG children placed by 15 months had mean SentRep accuracy of 65.9% (SD = 13.5%), which was equivalent to other FG children placed before and after 25 months and well below the NIG group. For MLU, the FG group placed after 25 months had a significantly longer utterance length than the IG group ($F(2,95) = 3.96$, $p = .022$). The difference between the two FG groups was not significant. That is, unlike NonRep and WI in which the significant BEIP intervention effect was due to the FG children placed by 25 months, for MLU the intervention effect was due to the FG children placed after 25 months. FG children placed by 15 months had a mean MLU of 6.0 morphemes (SD = 1.9), which was equal to the average MLU of the full FG group.

Effect of 42-Month Language Performance for Children in the Foster and Institution Groups

Excluding the three youngest children as in other analyses left 47 IG and 50 FG with RDLS scores available at 42 months. IG children had an average RDLS score of 47.3% (SD = 17.9%). FG children had an average of 59.9% (SD = 21.2%). Table 4 shows there were significant moderate Pearson correlations within each group between 42-month performance and SentRep, WI, and for the FG group NonRep at 8 years. Early language performance was anticipated to predict later language performance and we were mainly interested in whether there were different patterns of association for the IG and FG groups.

A bi-directional stepwise linear regression with the starting point of all main effects (group, 8-year language measures) and interaction effects was used to predict 42-month performance. The Akaike information criterion (AIC) was used to compare the relative goodness of fit of the regression models. If there was a difference in association between groups, a significant interaction effect should emerge. The only interaction effect in the selected model was for group x NonRep. However the effect was not significant (t (83) = 1.47, p =.146) and a scatter plot showed no discernible difference in trends across groups.

Summary

The FG group had significantly higher accuracy than the IG group on three of the four language measures, SentRep, MLU, and WI. Within the FG group, there was a significant effect of placement age for WI and NonRep, with children placed earlier showing higher accuracy than children placed later. The significant group and placement age effects for WI were due to the larger number of FG children placed before 25 months who were able to read at least some words (25 of 26, 96.2%) compared to the smaller number of FG children placed later and IG children (58 of 76, 76.4%). For MLU, FG children placed later outperformed IG children, while FG children placed earlier had equivalent performance to the IG group.

Even though there was a positive BEIP intervention effect in NonRep and WI, especially for early placement, the NIG group tended to have higher accuracy than FG children placed by 25 months on these two tasks and also in SentRep. However, children placed by 15 months appeared to perform as well as NIG children in NonRep and WI. Children's expressive language performance at 42 months was correlated with their 8-year language outcomes, except for MLU, with similar patterns of association for the IG and FG groups. Unlike their original group placement or earlier language outcomes, IG and FG children's current placement did not significantly affect their current language performance.

Discussion

We have shown previously that children who experience early severe deprivation have marked language deficits during the pre-school years. Children placed in a more optimal environment during the first 2 years of life have greater expressive and receptive language skills than those placed later (Windsor et al., 2011). The current study demonstrates that observable deficits in expressive language remain when the children are school-age; and that the ameliorative effects of placement by age 2 also are evident in some aspects of language. Indeed, children placed by 15 months had equivalent NonRep and WI performance to children who had never received institutional care. Children placed after 25 months on these two measures showed the same language deficits as children who originally were assigned to continued institutional care. That the positive effects of early placement age found at 42 months are still evident when the children are age 8 and living in a range of different care environments speaks clearly to the significance of early development.

These results parallel Croft et al.'s (2007) finding that early placement in a high-quality care environment is a critical factor in children's long-term language outcomes. However, our results differ from Croft et al.'s finding that, for children with longer than 6 months of institutional care, there was no correlation between duration of institutional care and any language task outcomes. Our results show that children placed earlier in foster care have better NonRep performance than children placed later. Also, a larger number of children placed earlier than placed later have letter knowledge and word identification skills. A key difference in language measures across the two studies is that Croft et al. (2007) used standardized tests and our study used criterion-referenced measures. It may be that standardized tests are not sufficiently sensitive to capture more subtle differences in later

language development during the school years. In our study, group and placement age effects were different across the different aspects of language assessed in the four tasks.

BEIP foster care intervention led to higher language performance for FG than IG children on three of the four language measures, SentRep, MLU, and WI, with the effect for WI disappearing when only the children who showed at least some minimal reading ability, including letter knowledge were considered. On the other hand, foster placement age had a significant effect on NonRep and WI, but not on SentRep or MLU. A single task is not sufficient to infer an underlying construct. However, it is interesting that group status but not placement age effects were found on the tasks that with a morphosyntactic component. Conversely, placement age but not group effects were evident on the tasks with a word learning component. That is, living in sub-optimal institutional care was detrimental to children's long-term word learning and morphosyntactic development. However, moving to high-quality foster care earlier, especially before 25 months, facilitated stronger word learning development. Moving to high-quality foster care before 33 months (the latest date of placement for any FG child) facilitated long-term morphosyntactic development, but not in a way that was associated with the specific age at which children moved to the high-quality care environment.

That there are different findings for different aspects of language accords well with there being different trajectories of lexical-semantic and grammatical growth for young children (Bates et al., 1994). Word learning takes place earlier than grammatical development. It may be that experience before 2 years is pivotal for lexical skills and experience during a longer or later time frame is more important for early grammatical development. However, the language tasks in the current study were not chosen to make a lexical-grammatical comparison and our data are not sufficient to make any strong claims about this specific issue.

Importantly, even though the IG and FG groups did not show the same language proficiency at 8 years as their typically developing NIG peers, their language skills had continued to develop from younger ages. Unlike the one- to two-morpheme sentences which characterized the IG group's language at 42 months (Windsor et al., 2011), the IG group were using five-morpheme sentences at 8 years. Similarly, the FG group's sentence length had increased from two- to three-morpheme sentences to six-morpheme sentences at 8 years. We did not find large discontinuities in language development for the FG group. Rather, where we found a difference in performance for FG children placed before and after 25 months, this was in the context of a significant linear correlation between age and performance. In this sense, we did not find strong evidence for a particular invariant period during which children's language development was less modifiable in the classic sense of a critical period. As at 42 months, there was a graded impact of placement age on language performance.

However, using the more categorical lens of whether FG children did or did not achieve language that was within age-expectations at 8 years, the cutoff point of 15 months that was examined at 42 months continued to be an important marker. Children placed by 15 months performed on average as well as their typically developing community peers in NonRep and

WI. In the BEIP cohort, children who moved from a severely depriving context to high-quality care during the first year of life show language growth that is resilient to the negative effects of deprivation.

Overall, the expressive language skill which the IG and FG children showed at 42 months was predictive of their 8-year language outcomes, confirming the significance of the children's early language experience. There was, however, no difference between groups in the trend of the association between 42-month and 8-year performance. That is, the two groups showed no discernible difference in the trajectory of language growth.

Notably, children's 42-month language status was not correlated with MLU at 8 years. Also, MLU was one of the measures on which there was no correlation with FG placement age at 8 years. Indeed, although the difference was not significant, FG children placed before 25 months tended to have a slightly lower average MLU than children placed later (5.7 vs. 6.3 morphemes). By contrast, Windsor et al. (2011) found that FG placement age was significantly correlated with MLU at 42 months. In their discussion of internationally adopted children's school-age language performance, Scott et al. (2008) draw attention to Cummins' (1984) classic distinction between language that serves academic purposes and language used in interpersonal communication. Specifically, that proficiency in the types of language used for academic purposes may be more difficult to achieve than conversational language. Even though there are IG-FG group differences in MLU at 8 years, the children show robust grammatical performance (see Appendix B). It may be that the children's sentence length in spontaneous conversation is not as sensitive a measure of any foster placement age effects as the other three elicited language measures.

Finally, the children's current placement status had no significant effect on their language performance. Fox et al. (2011) found that the intervention effect of foster care on IQ was stronger for children who remained in BEIP foster care at 8 years. Here, the age of placement effects for NonRep and WI were similar for FG children who remained in BEIP foster care and children with other placement status at 8 years. It is important to note that our statistical analysis of current placement was in the context of the IG-FG group comparison. That is, as shown in Table 2, current placement was not as powerful or systematic a way to describe children's performance as was children's original intent-to-treat group status. Notably, there were a small number of FG children in government foster care at 8 years, with larger variability on some language measures within this current status than for other FG current status. It is possible that current placement status may have had greater predictive power with more equivalent and larger sample sizes. Even so, this would not weaken the robust effects of children's original placement and age of foster placement on their school-age language skills.

Acknowledgments

The Bucharest Early Intervention Project (BEIP) was funded by the John D. and Catherine T. MacArthur Foundation Research Network on Early Experience and Brain Development (Charles A. Nelson, Network Chair). We are grateful to Hermi R. Woodward and the dedicated BEIP research staff. In particular, we thank Nicoletta Corlan, Erika Hoyt, Cornelia Iucha, Ana Moraru, Nadia Radu, and Anca Radulescu for their assistance with task development and data collection.

References

Behen M, Helder E, Rothermel R, Solomon K, Chugani HT. Incidence of specific absolute neurocognitive impairment in globally intact children with histories of early severe deprivation. Child Neuropsychology. 2008; 14:453–469. [PubMed: 18686074]

Beverly BL, McGuninness TM, Blanton DJ. Communication and academic challenges in early adolescence for children who have been adopted from the former Soviet Union. Language, Speech and Hearing Services in Schools. 2008; 39:303–313.

Carroll, JR.; Davies, P.; Richman, B., editors. The American heritage word frequency book. Boston, MA: Houghton Mifflin Company; 1971.

Chiat S, Roy P. Early phonological and sociocognitive skills as predictors of later language and communication outcomes. Journal of Child Psychology and Psychiatry. 2008; 49:635–645. [PubMed: 18341547]

Cohen NJ, Lojkasek M, Zadeh ZY, Pugliese M, Kiefer H. Children adopted from China: A prospective study of their growth and development. Journal of Child Psychology and Psychiatry. 2008; 49:458–468. [PubMed: 18221351]

Conti-Ramsden G, Botting N, Faragher B. Psycholinguistic markers for specific language impairment (SLI). Journal of Child Psychology and Psychiatry. 2001; 42:741–748. [PubMed: 11583246]

Croft C, Beckett C, Rutter M, Castle J, Colvert E, Groothues, Sunuga-Barke EJ. Early adolescent outcomes of institutionally deprived and non-deprived adoptees. II: Language as a protective factor and a vulnerable outcome. Journal of Child Psychology and Psychiatry. 2007; 48:31–44. [PubMed: 17244268]

Cummins, J. Bilingualism and special education: Issues in assessment and pedagogy. San Diego, CA: College Hill Press; 1984.

Devescovi A, Caselli MC. Sentence repetition as a measure of early grammatical development in Italian. International Journal of Language and Communication Disorders. 2007; 42:187–208. [PubMed: 17365093]

Devescovi A, Caselli MC, Marchione D, Pasqualetti P, Reilly J, Bates E. A crosslinguistic study of the relationship between grammar and lexical development. Journal of Child Language. 2005; 32:759–786. [PubMed: 16429710]

Dinu, A.; Dinu, LP. On the data base of Romanian syllables and some of its quantitative and cryptographic aspects. Proceedings of the European Languages Resources Association; Genoa, Italy. 2006. p. 1795-1798.

Edwards, S.; Fletcher, P.; Garmna, M.; Hughes, A.; Letts, C.; Sinka, I. The Reynell Developmental Language Scales III. Berkshire, UK: Nfer-Nelson Publishing; 1997.

Fox NA, Almas AN, Degnan KA, Nelson CA, Zeanah CH. The effects of severe psychosocial deprivation and foster care intervention on cognitive development at 8 years of age: Findings from the Bucharest Early Intervention Project. Journal of Child Psychology and Psychiatry. 201110.1111/j.1469-7610.2010.02355.x

Gathercole SE, Baddeley AD. Evaluation of the role of phonological STM in the development of vocabulary in children. Journal of Memory and Language. 1989; 28:200–213.

Graf-Estes K, Evans JL, Else-Quest NM. Differences in nonword repetition of children with and without language impairment; A meta-analysis. Journal of Speech, Language, and Hearing Research. 2007; 50:177–195.

Huttenlocher J, Vasilyeva M, Cymerman E, Levine S. Language input and child syntax. Cognitive Psychology. 2002; 45:337–374. [PubMed: 12480478]

Law J, Garrett Z, Nye C. The efficacy of treatment for children with developmental speech and language delay/disorder: A meta-analysis. Journal of Speech, Language, and Hearing Research. 2004; 47:924–943.

Loman MM, Wiik KL, Frenn KA, Pollak SD, Gunnar MR. Postinstitutionalized children's development: Growth, cognitive, and language outcomes. Journal of Developmental and Behavioral Pediatrics. 2009; 30:426–434. [PubMed: 19692931]

Nelson CA, Zeanah CH, Fox NA, Marshall PJ, Smyke AT, Guthrie D. Cognitive recovery in socially deprived young children: The Bucharest Early Intervention Project. Science. 2007; 318:1937–1940. [PubMed: 18096809]

Peisner-Feinberg ES, Burchinal MR, Clifford RM, Culkin ML, Howes C, Kagan SL, Yazejian N. The relation of preschool child-care quality to children's cognitive and social developmental trajectories through second grade. Child Development. 2001; 72:1534–1553. [PubMed: 11699686]

Scott KA, Roberts JA, Krakow R. Oral and written language development of children adopted from China. American Journal of Speech-Language Pathology. 2008; 17:150–160. [PubMed: 18448602]

Semel, E.; Wiig, EH.; Secord, WA. Clinical Evaluation of Language Fundamentals-4. San Antonio, TX: Psychological Corporation; 2003.

Snedeker J, Geren J, Shafto CL. Starting over: International adoption as a natural experiment in language development. Psychological Science. 2007; 18:79–87. [PubMed: 17362382]

Stokes SF, Wong AMY, Fletcher P, Leonard LB. Nonword repetition and sentence repetition as clinical markers of specific language impairment: The case of Cantonese. Journal of Speech, Language, and Hearing Research. 2006; 49:219–236.

Werker JF, Tees RC. Speech perception as a window for understanding plasticity and commitment in language systems in the brain. Developmental Psychobiology. 2005; 46:233–251. [PubMed: 15772961]

Windsor J, Benigno JP, Wing CA, Carroll PJ, Koga SF, Nelson CA, Fox NA, Zeanah CH. Effect of foster care on young children's language learning. Child Development. 2011; 82 no. 10.1111/j.1467-8624.2011.01604.x

Windsor J, Glaze LE, Koga SF. the Bucharest Early Intervention Project Core Group. Language acquisition with limited input: Romanian institution and foster care. Journal of Speech, Language, and Hearing Research. 2007; 50:1365–1381.

Woodcock, RW.; McGrew, KS.; Mater, N. Woodcock-Johnson III Tests of Cognitive Abilities. Itasca, IL: Riverside Publishing; 2001.

Zeanah CH, Nelson CA, Fox NA, Smyke AT, Marshall P, Parker SW, et al. Designing research to study the effects of institutionalization on brain and behavioral development: The Bucharest early intervention project. Development and Psychopathology. 2003; 15:885–907. [PubMed: 14984131]

Appendix A

Table A1

Nonword Repetition Task Stimuli

1-syllable	2-syllable	3-syllable	4-syllable
1. nel	11. chetan	21. cârmălăi	31. duplezare
2. froi	12. piscoi	22. ciucălat	32. împălărat
3. vol	13. cioană	23. păreaşă	33. trelaseră
4. gort	14. trelăi	24. gosponind	34. retinşare
5. bilc	15. stegand	25. vrederă	35. osmineală
6. stap	16. genic	26. chiţiboi	36. debarcadând
7. pran	17. morizi	27. camitră	37. jicorniţă
8. brei	18. furel	28. tilane	38. pandolină
9. jed	19. ugher	29. căleţa	39. mironebre
10. chen	20. coşac	30. păneşti	40. torăşoară

Note. Nonwords were presented from 1 to 40.

Table A2

Sentence Repetition Task Stimuli

1	Şoferul conducea cu atenţie. (The driver was driving carefully.)
2	Unde sunt cărţile mele? (Where are my books?)
3	Prietena mea este mai înaltă decât mine. (My friend is taller than I am.)
4	Unde s-au ascuns cele două fetiţe? (Where did those two little girls hide?)
5	Băiatul nu i-a pus zgardă câinelui. (The boy did not put a leash on the dog.)
6	N-ai mâncat deja toate bomboanele? (Didn't you already eat all the candy?)
7	Telefonul era pe masa de lângă pat. (The telephone was on the table next to the bed.)
8	Trenul merge mult mai repede decât tramvaiul. (The train goes much faster than the tram.)
9	Pisicilor nu le place să mănânce decât carne. (The cats do not like to eat anything but meat.)
10	Castelul fusese construit in secolul trecut. (The castle was built during the last century.)
11	Laptele din farfurie n-a fost băut de pisicuţă. (The mik in the plate was not drunk by the kitty.)
12	Galben este culoarea preferată a mamei lui Radu. (Yellow is the favorite color of Radu's mother.)
13	În clasă nu se aflau decât două mese şi un scaun. (In the clasSentRepoom there were only two tables and one chair.)
14	Cu care autobuz se ajunge la cinematograful din centru? (Which bus gets one to the downtown cinema?)
15	Înainte să se aşeze la masă, copiii s-au spălat pe mâini. (Before sitting at the table, the children washed their hands.)
16	El a intrat in librărie, a ales o carte si apoi a plătit-o. (He entered the bookstore, chose a book, and then paid for it.)
17	Dacă autobuzul nu vine la timp, pierdem trenul de ora cinci. (If the bus does not come on time, we will miss the five o'clock train.)
18	Din când în când, doamna învăţătoare le spunea câte o poveste. (From time to time, the teacher told them a story.)
19	După ce au câştigat meciul, toţi jucătorii erau foarte bucuroşi. (After they won the match, all the players were very cheerful.)
20	Dacă nu ploua astăzi, am fi mers la plajă. (If it wasn't raining today, we would have gone to the beach.)
21	Bunica nu privea niciodată desene animate la televizor. (The grandmother never watched cartoons on television.)
22	Fetiţa nu purta mănuşi chiar dacă afară era frig. (The little girl was not wearing mittens even though it was cold outside.)
23	La grădina zoologică am văzut cămile, girafe şi tigri. (At the zoowe saw camels, giraffes, and tigers.)
24	În fiecare zi cocoşul trezea toată casa dis-de-dimineaţă. (Each day the rooster woke up the whole household at the crack of dawn)
25	Dacă băiatul s-ar fi trezit mai devreme nu ar fi întârziat la şcoală. (If the boy had woken up earlier he would not have been late to school.)
26	Cine a adunat cele mai multe flori, va face cel mai mare buchet. (Whoever gathered the most flowers will make the biggest bouquet.)
27	Merele de anul acesta sunt mai gustoase decât cele de anul trecut. (The apples from this year are tastier than those from last year.)
28	Înainte să se întoarcă acasă din excursie, copiii au mers cu barca pe lac. (Before returning home from a trip, the children went boating on a lake.)
29	În seara asta putem să stăm până mai târziu, pentru că mâine este duminică. (Tonight we can stay up later because tomorrow is Sunday.)
30	Acum trei săptămâni, colega mea a cumpărat un stilou nou, iar săptămâna trecută l-a pierdut. (Three weeks ago my classmate bought a new pen, but last week she lost it.)
31	Acum patru ani, în oraşul nostru s-au înregistrat cele mai joase temperaturi din ţară. (Four years ago, the lowest temperatures in the country were recorded in our city.)

32	Dintre toate cărţile împrumutate de la bibliotecă, cea cu poze ne-a plăcut cel mai mult. (Out of all the books borrowed from the library, we liked the one with pictures the most.)

Note. Sentences were presented in order from 1 to 32.

Table A3

Word Identification Task Stimuli

1	da (yes)
2	pe (on)
3	mic (small)
4	zi (day)
5	la (at)
6	este (is)
7	mână (hand)
8	copii (children)
9	foarte (very)
10	peste (over)
11	unde (where)
12	masă (table)
13	lună (moon)
14	pâine (bread)
15	frate (brother)
16	scaun (chair)
17	tare
18	singur (alone)
19	spălat (washed)
20	cânta (was singing)
21	a dormi (to sleep)
22	trist (sad)
23	picior (leg)
24	acoperiş (roof)
25	maimuţă (monkey)
26	a povesti (to tell)
27	cântărit (weighed)
28	anotimp (season)
29	doisprezece (twelve)
30	poezie (poetry)
31	cleşte (pliers)
32	dezamăgit (disappointed)
33	colier (necklace) (aloud)
34	marcat (labeled)
35	secetă (drought)
36	înţelepciune (wisdom)
37	încântat (elated)

38	piramidă (pyramid)
39	a analiza (to analyze)
40	străbun (ancestor)
41	instrument (instrument)
42	peruca (wig)
43	naţionalitate (nationality)
44	a condimenta (to spice)
45	ciuguli (peck)
46	emisferă (hemisphere)
47	contempla (was contemplating)
48	antichitate (anitiquity)
49	vertebră (vertebrae)
50	invincibil (invincible)

Note. Words were presented in order from 1 to 50.

Appendix B

Table B1

Portion of Language Sample from the Institution Group

NIG: Mie îmi place ăla cu scrisul.(*I like that one with the writing*.)
IG: Ne place şi Power Ranger, nu? (*We also like Power Ranger, no?*)
NIG: Da. (*Yes*.)
IG: Eu mă uit. Ce-ai văzut, cine e Corak? (*I watch it. What did you see, who is Corak?*)
NIG: Corak e din echipa cea mai rea. (*Corak is from the most evil team.*)
IG: Cora e soţia lu' Dona, e Limbo. (*Cora is the wife of Dona, it's Limbo*.)
NIG: Ştiam. (*I knew that*.)
IG: Ţinic e boul. (*Ţinic is the bull*.)
NIG: Ştiam! Ştiam şi eu asta destul de bine. (*I knew that*! *I also knew that very well*.)
IG: Da' cel cu mustăţi e Ţip e fiul lui? (*And the one with the mustache Ţip, is his son?*)

Note. IG = child from the institution group, NIG = child from the non-institution group.

Table B2

Portion of Language Sample from the Foster Group

NIG: Mie îmi place să mă joc fotbal cu băieţii. (*I like to play football with the boys*.)
FG: Şi mie îmi place fotbalul. (*I also like football*.)
NIG: Deci una. (*So [we have] one*.)
FG: Da' de ce vorbeşti aşa de încet? (*Why are you speaking so quietly?*)
NIG: A doua. (*The second one*.)
FG: A doua … să alergăm. (*The second one … to run*.)
NIG: Da alergăm. (*Yes we run*)
FG: Bine aa … bine. (*Alright ah … alright*.)
NIG: Să ne jucăm cu păpuşile. (*To play with the dolls*.)

FG: Da. Să ne uităm la desene. (*Yes. To watch cartoons*.)

Note. FG = child from the institution group, NIG = child from the non-institution group.

Table 1

Group Mean Scores on the Language Measures

Group	*N*	Nonword repetition	Sentence repetition	Word identification	Mean length of utterance
IG	50	96.2 (3.4)	57.5 (17.1)	43.7 (33.2)	5.4 (1.3)
FG	52	96.4 (4.0)	64.4 (15.8)	56.9 (28.2)	6.0 (1.3)
NIG	37	99.1 (3.7)	84.5 (13.7)	73.8 (26.0)	---

Note. In all tables, nonword repetition (NonRep), sentence repetition (SentRep), and word identification (WI) are percentage scores. Mean length of utterance (MLU) is in morphemes. Standard deviations are shown in parentheses. IG $N = 45$ and FG $N = 51$ for MLU.

Table 2

Mean Scores on the Language Measures for Institution and Foster Group Children Across Current Placement Status

Group	*N*	Nonword repetition	Sentence repetition	Word identification	Mean length of utterance
IG in institutional care	11	96.6 (2.4)	60.3 (15.4)	55.3 (21.9)	5.2 (1.2)
IG in government foster care	15	96.1 (3.4)	54.0 (16.4)	62.8 (25.2)	5.4 (1.3)
IG in other placement	24	96.1 (3.9)	58.4 (18.5)	58.0 (24.6)	5.5 (1.4)
FG in BEIP foster care	24	96.9 (3.0)	64.8 (13.8)	65.4 (20.9)	6.1 (1.5)
FG in government foster care	6	92.2 (8.8)	64.9 (21.7)	60.0 (24.9)	6.2 (0.7)
FG in other placement	22	97.1 (2.2)	63.8 (17.0)	64.3 (18.7)	5.8 (1.0)

Note. Standard deviations are shown in parentheses. Other current placements included reintegration with the biological family, placement with another, adoption, and living in an apartment.

Table 3

Mean Scores on the Language Measures for Foster Group Children Placed Before and After 25 Months

Group	*N*	Nonword repetition	Sentence repetition	Word identification	Mean length of utterance
Placed by 25 months	26	97.7 (3.4)	64.9 (14.5)	65.5 (22.1)	5.7 (1.5)
Placed after 25 months	26	95.1 (4.9)	63.9 (17.3)	48.2 (31.1)	6.3 (1.0)

Note. Standard deviations are shown in parentheses. Foster Group Placed by 25 months $N = 25$ for MLU.

Table 4

Pearson Correlations Between the 42-Month Language Performance and Each 8-Year Language Performance Measure for the IG and FG Groups

Group	*N*	Nonword repetition	Sentence repetition	Word identification	Mean length of utterance
IG	47	.199	.408**	.300*	−.035
FG	50	.398**	.515**	.482**	−.100

Note. The 42-month language measure was the expressive percentage score on the adaptation of the Reynell Developmental Language Scales (RDLS).

* $p < .05$,

** $p < .01$