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Effect of Foster Care on Young Children's Language Learning

Jennifer Windsor
University of Minnesota

Joann P. Benigno
Ohio University

Christine A. Wing
University of Minnesota

Patrick J. Carroll
The Ohio State University

Sebastian F. Koga
University of Virginia

Charles A. Nelson III
Harvard Medical School and Children's Hospital Boston

Nathan A. Fox
University of Maryland

Charles H. Zeanah
Tulane University

This report examines 174 young children's language outcomes in the Bucharest Early Intervention Project, the first randomized trial of foster placement after institutional care. Age of foster placement was highly correlated with language outcomes. Placement by 15 months led to similar expressive and receptive language test scores as typical age peers at 30 and 42 months. Placement from 15 to 24 months also led to dramatic language improvement. In contrast, children placed after 24 months had the same severe language delays as children in institutional care. Language samples at 42 months confirmed that placement after 24 months led to lower expressive skill.

It is now well documented that poor social and physical environments have substantial negative effects on children's development. Much of this research has focused on suboptimal orphanage or other institutional care and the ameliorative influence of subsequent foster or adoptive care (see Maclean, 2003, for review). Children's language after institutional care has begun to receive particular attention, in part because language is a key marker of academic and social competence. This article reports on language outcomes from a longitudinal study of institutional and foster care, the Bucharest Early Intervention Program (BEIP; Zeanah et al., 2003).

Recent information about effects of institutional care on language development comes mainly from studies of international adoption from various care environments (van IJzendoorn, Juffer, & Poelhuis, 2005). Infants and toddlers adopted into the United States from Russia, Eastern Europe, and China appear to acquire English quickly and in a predictable way, often meeting developmental expectations for receptive and/or expressive language 1–2 years after adoption (Cohen, Lojkasek, Zadeh, Pugliese, & Kiefer, 2008; Glennen, 2007; Snedeker, Geren, & Shafto, 2007). Children adopted at later ages may show below-age performance for a longer period than children adopted earlier (Glennen & Masters, 2002; Roberts et al., 2005).

Romanian institutions historically have presented an instance of very severe environmental deprivation, with limited opportunities for language input and social interaction. Based mainly on parental report, many children adopted internationally from Romanian institutions also appear to make substantial gains if placed in family settings

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Correspondence concerning this article should be addressed to Jennifer Windsor, Department of Speech-Language-Hearing Sciences, 115 Shevlin Hall, University of Minnesota, 164 Pillsbury Drive S.E., Minneapolis, MN 55455. Electronic mail may be sent to windsor@umn.edu.

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early in life (Hoksbergen, ter Laak, Rijk, van Dijkum, & Stoutjesdijk, 2005; Morison, Ames, & Chisholm, 1995; Rutter & the English and Romanian Adoptees Study Team, 1998).

More recently Croft et al. (2007) examined long-term English language test outcomes for Romanian children adopted into the United Kingdom. The children were 6–42 months old when they entered the United Kingdom, and most had been in institutional care since birth. Croft et al. found that children with fewer than 6 months of institutional care showed minimal negative language effects at 6 and 11 years of age. Children in institutional care longer than 6 months showed very poor language, but there was no correlation between language outcomes and duration of institutional care from 6 to 42 months. While outcomes after poor institutional care appear to be probabilistic (Rutter, Kreppner, & O'Connor, 2001), Croft et al.'s results suggest that it is the early presence rather than length of impoverished input that matters more. However, as Croft et al. discuss, these school-age language outcomes cannot be generalized to the emerging language of young children.

This report focuses on BEIP language outcomes at 30 and 42 months of age. In addition to assessing earlier outcomes than Croft et al. (2007), the BEIP randomized design controls for selection biases that may influence foster placement. A second advantage of the BEIP is that the foster placement is within country. This enables study of children learning their native language, avoiding the challenge in international adoption studies of accounting for switching to a second language in a different cultural and economic context.

Nelson et al. (2007) reported on BEIP cognitive outcomes. The developmental quotient of children in institutional care was markedly below that of children in foster care. Children placed in foster care before 24 months of age had significantly higher quotients at 42 months than children placed later. However, rather than the categorical effect of early placement found by Croft et al. (2007) for language, cognitive outcomes were correlated with age of foster placement.

Using language samples, Windsor, Glaze, Koga, and the BEIP Core Group (2007) reported on Romanian language outcomes of a small subset of the BEIP cohort at 30 months of age. Large speech and language delays were evident for the children in institutional care and for children in foster care for only a short period. Children placed in foster care before 24 months had an equivalent number of utterances and equivalent speech intelligibility to typically developing community peers. However, the community peers had longer utterances than all other groups. The full cohort of BEIP language outcomes at 30 and 42 months of age is examined here. The key questions were whether foster care placement facilitated children's language outcomes and how placement age affected outcomes.

Method

Participants

The BEIP follows children living in institutional care in Bucharest who were randomized to foster care (FG group) or continued institutional care (IG group) by 31 months of age. Children with medical conditions were not included in either group. At the time of the study, Romanian institutional care was characterized by highly structured routines, impoverished stimulation, and a very low ratio of caregivers to children. To place children in foster care, Zeanah et al. (2003) worked with Romanian agencies to identify high-quality foster homes that otherwise would not have been available. The randomized trial followed ethical considerations (Zeanah et al., 2006), and children were placed in alternative settings if these became available. Thus, the BEIP is an ''intent-to-treat'' study in which analysis is based on participants' original group assignment, providing for a conservative test of foster placement. Typical age peers living with their biological families in the same community also participated (NIG group). Detailed participant information is reported elsewhere (Nelson et al., 2007; Zeanah et al., 2003).

Language test scores were available at baseline (prerandomization), 30, and 42 months of age for a total of 60 IG children (29 males), 57 FG children (29 males), and 57 NIG children (27 males) (Table 1). Two IG children had been reintegrated with their biological families at 42 months. Average placement age for the FG group was 22 months (SD = 7). Language samples were obtained from a randomly selected subset of children at 42 months: 20 FG (10 males), 20 NIG (9 males), and 23 IG children (11 males). The IG sample was larger in anticipation that some children might not have expressive language.

To examine placement age, a correlation analysis was carried out. Also, the FG group was divided into four subgroups. These included children placed in foster care by 15 months of age (n = 12 at 30 and 42 months), from 16 to 24 months (n = 14 at 30 months, n = 16 at 42 months), and from 25 to 29 months (n = 11 at 30 months, n = 14 at

Table 1
Mean REEL, RDLS, and Bayley Scores for Groups at Each Assessment Point

		Bayley quotient		REEL quotient			RDLS percentage		
Assessment	Group	DQ	*N*	Expressive	Receptive	*N*	Expressive	Receptive	*N*
Baseline	IG	77.1 (9.8)	12	49.8 (16.4)	79.8 (14.6)	12			
	FG	81.1 (15.1)	17	52.1 (24.1)	73.7 (21.3)	17			
	NIG	103.4 (10.5)	56	100.8 (18.7)	112.5 (16.6)	56			
30 months	IG	77.2 (11.4)	59	64.0 (17.3)	74.8 (15.3)	59	14.5 (13.6)	34.0 (32.6)	52
	FG	81.9 (11.6)	53	74.2 (21.4)	83.3 (17.5)	53	21.8 (19.5)	41.5 (14.0)	49
	NIG	102.2 (12.7)	57	104.7 (14.6)	109.7 (9.7)	57	53.2 (19.7)	66.0 (14.7)	57
42 months	IG	78.9 (12.6)	60				49.0 (20.0)	62.0 (12.7)	60
	FG	85.7 (14.2)	57				60.0 (24.0)	71.2 (16.0)	57
	NIG	103.3 (11.9)	51				88.7 (15.3)	90.2 (9.1)	51

Note. Standard deviations are in parentheses. IG = institution group; FG = foster group; NIG = noninstitution group; DQ = Bayley Developmental Quotient; REEL = Receptive–Expressive Emergent Language Scale; RDLS = Reynell Developmental Language Scales.

42 months). The fourth subgroup included children placed after 29 months, who had minimal foster care at 30 months of age (n = 12 at 30 months, n = 15 at 42 months). The 57 foster children at 42 months included all 49 children at 30 months. Two subgroups were used with the smaller number of FG children with language samples at 42 months: placement before and after 24 months (n = 10 in each subgroup).

Materials and Procedures

Romanian is a highly inflected Romance language that retains some Latin features and borrows from Slavic languages. There are no standardized Romanian language tests, and two measures used clinically in Romania were administered. At the baseline and 30-month assessments, a parent and caregiver questionnaire was used, the Receptive–Expressive Emergent Language Scale (REEL; Bzoch & League, 1971). The questionnaire is designed for birth to 3 years and has 62 expressive items (REEL–E) and 62 receptive items (REEL–R), assessing skills such as following simple directions, babbling, and producing words. A few expressive items are English specific (e.g., producing particular consonant–vowel combinations), but any effect would be equivalent across groups.

At 30 and 42 months, a translation of the Reynell Developmental Language Scales–III (RDLS; Edwards et al., 1997) was used, with this test designed for children aged 1.3–7.6. The 62 Expressive items include object labeling, inflections, clauses, auxiliaries, and questions. The 62 Receptive items assess object recognition, following directions, and inferences. Informant report and item analysis of NIG performance were used to determine relevant RDLS items. Two Romanian-speaking informants identified the first four Expressive subtests were appropriate, but the remaining two subtests (e.g., Complex Sentences, Negatives) did not obligate particular Romanian grammatical structures as in English. The first nine Receptive subtests were appropriate, but the final subtest involving wh-questions could not be translated in a meaningful way. Confirming the informant report, the item analysis showed very low to zero accuracy on the final two Expressive subtests, the final Receptive subtest, and the final item in the second last Receptive subtest. RDLS percentage scores were calculated from the first four Expressive subtests (38 items) and first nine Receptive subtests, excluding the final item in the ninth subtest (53 items).

The item exclusion left many test items examining receptive grammar but fewer items assessing complex grammar expression. Thus, Romanian language samples were obtained at 42 months from the subset of 63 randomly selected children. The 10-min samples were from videotaped free play with the caregiver or mother using a standard toy set. Mean utterance length (MLU) was calculated from the full sample in words and morphemes (see the Appendix). Grammatical errors also were identified, following the conventional calculation of errors as any change in obligatory aspects of Romanian adult grammar.

The Bayley Scales of Infant Development II (Bayley, 1993) also was administered to all children at 30 and 42 months. The Mental Development Index was obtained, with this standard score representing a range of cognitive abilities. The Bayley includes a language component; however, includ-

ing this cognitive measure provided a broader basis for interpreting the language outcomes. A developmental quotient (DQ) was derived using [extrapolated age equivalent score/chronological age]/100 (Nelson et al., 2007). All language and cognitive measures were administered in Romanian by trained personnel.

Results

Group Effects for the RDLS, REEL, and Bayley

Table 1 shows groups' language and cognitive scores at baseline, 30, and 42 months. The IG and FG groups had equivalent language scores at baseline: REEL–R, $t(27) = 0.86$, $p = .40$, and REEL–E, $t(27) = -0.30$, $p = .77$. Both groups showed higher receptive than expressive quotients: IG, $t(11) = 6.88$, $p = .001$, $d = 1.85$, and FG, $t(16) = 5.04$, $p = .001$, $d = 1.16$. However, this pattern also held for the comparison NIG group.

At 30 months, a multivariate analysis of variance indicated a significant group effect, Wilks's Lambda = .40, $F = 17.42$, $p = .001$. Follow-up Tukey honestly significant difference (HSD) tests ($q_a = .01$) showed the NIG group significantly outperformed the other two groups on all five measures (all ds ≥ 1.58). The IG and FG groups did not differ significantly in DQ, RDLS, or REEL–E scores; however, the FG group had significantly higher REEL–R scores ($d = 0.53$). At 42 months, there again was a significant group effect on the RDLS and Bayley, Wilks's Lambda = .54, $F = 19.65$, $p = .001$, with the NIG group showing significantly higher accuracy than the other two groups on all three measures (HSD $q_\alpha = .01$, all ds ≥ 1.15). In contrast to 30 months, the FG group had significantly higher Expressive ($d = 0.50$) and Receptive RDLS scores ($d = 0.63$) than the IG group at 42 months. The two groups did not differ significantly in DQ. All language measures were significantly correlated ($p < .01$) with the Bayley DQ, with $r = .64$ and above in each correlation at both assessments.

Placement Age Effects for the RDLS

Correlation between placement age and RDLS scores. Examining placement timing clarified the intervention effect of foster care. For FG children with RDLS scores at both 30 and 42 months ($n = 49$), placement age was highly correlated ($p < .01$) with expressive and receptive language at 30 months (Receptive $r = -.71$, Expressive $r = -.75$) and 42 months (Receptive $r = -.61$, Expressive $r = -.66$; see Figure 1). RDLS scores also were highly correlated across the 30- and 42-month assessments (Receptive $r = .78$, Expressive $r = .67$).

RDLS scores for foster subgroups. For the subgroup analysis, RDLS percentages were converted to z scores based on the NIG group mean and standard deviation (Figure 2). At 30 months, there were significant subgroup differences: Receptive, $F(4, 96) = 14.94$, $p = .001$, and Expressive, $F(4, 96) = 15.85$, $p = .001$. The subgroup placed by 15 months had higher RDLS scores than all other subgroups (HSD $q_a = .01$, all ds ≥ 0.97) and the IG group (Receptive $d = -1.93$, and Expressive $d = -1.94$). The two subgroups placed after 24 months did not differ significantly from the IG group. The subgroup placed before 15 months actually had an equivalent

Figure 1. Correlation between Reynell Developmental Language Scale (RDLS) Expressive percentage scores and placement age for the foster group at 42 months ($n = 49$).

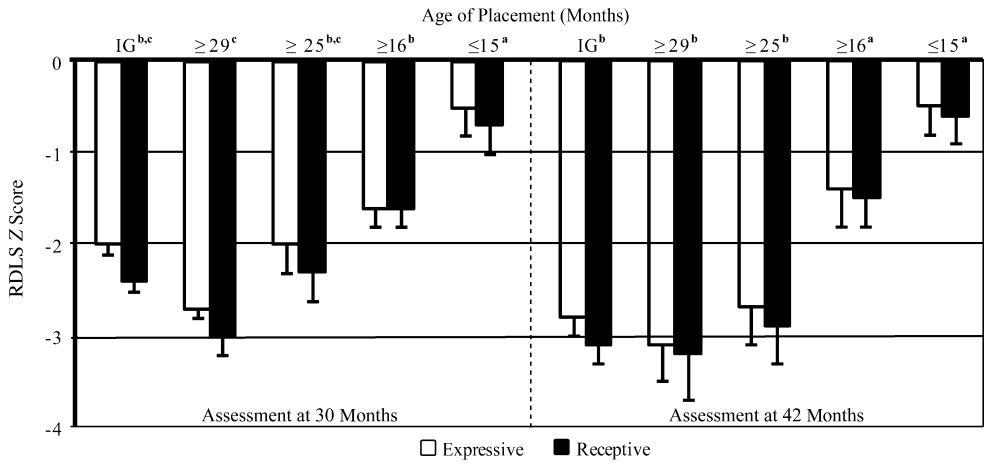

Figure 2. Reynell Developmental Language Scale (RDLS) Expressive and Receptive *z* scores by placement age for the foster group at 30 and 42 months.
Note. Foster subgroups with a different superscript were significantly different ($a = .05$); expressive and receptive means were equivalent. ≤ 15 = placed by 15 months; ≥ 16 = 16–24 months; ≥ 25 = 25–28 months; ≥ 29 = after 29 months; IG = institution group.

Expressive percentage to the NIG group, $t(67) = -1.56$, $p = .12$, although the subgroup had a lower Receptive percentage, $t(67) = -2.03$, $p = .047$, $d = -0.64$. Children performed similarly within subgroups. Only 2 of 12 children placed by 15 months but 20 of 23 placed after 24 months had Expressive scores below −1.5 *SD*, $\chi^2(1) = 16.69$, $p = .001$, and 3 versus 21 children for Receptive scores, $\chi^2(1) = 16.09$, $p = .001$.

The 42-month findings resembled those at 30 months. There were significant subgroup differences: Receptive, $F(4, 104) = 13.57$, $p = .001$, and Expressive, $F(4, 104) = 13.74$, $p = .001$. The FG subgroups placed by 24 months were not significantly different; both subgroups scored significantly higher than subgroups placed later and the IG group. The subgroup placed by 15 months had equivalent mean RDLS percentage scores to the NIG group: Receptive, $t(61) = -1.75$, $p = .09$, and Expressive, $t(61) = -1.41$, $p = .16$. Only 1 of 12 children placed by 15 months versus 25 of 29 children placed after 24 months had Expressive scores below −1.5 *SD*, $\chi^2(1) = 22.19$, $p = .001$, and 2 versus 27 children for Receptive scores, $\chi^2(1) = 23.96$, $p = .001$.

Group and Placement Age Effects for Utterance Length at 42 Months

Of the 23 IG children with language samples, 2 produced three or fewer utterances. MLU was calculated as 0 for these children; the children were excluded in calculating grammatical errors. One NIG child had average intelligence but an unexpectedly low MLU, meeting the criterion for specific language impairment. Another NIG child had a low Bayley score. To be conservative, these children were excluded, reducing NIG group size to 18. All 20 FG children provided usable samples. Mean sample size for the IG group was 77.9 utterances (*SD* = 8.1). The FG children placed before and after 24 months had means of 83.5 (*SD* = 11.1) and 75.0 (*SD* = 9.4) utterances, respectively. The NIG mean was 76.5 utterances (*SD* = 8.0). There was no significant group difference in sample size, $F(3, 57) = 0.272$, $p = .845$.

Utterance length. The IG group had a mean MLU of 1.62 words (*SD* = 0.58) and 1.86 morphemes (*SD* = 0.68). The FG children placed after 24 months had an equivalent MLU of 1.57 words (*SD* = 0.22) and 1.82 morphemes (*SD* = 0.27). FG children placed before 24 months had longer utterances (MLU-words = 2.12, *SD* = 0.40; MLU-morphemes = 2.45, *SD* = 0.47). This was equivalent to NIG performance (MLU-words = 2.50, *SD* = 0.66; MLU-morphemes = 2.96, *SD* = 0.88). There was a significant group effect for MLU-words, $F(3, 57) = 12.33$, $p = .001$, $d = 1.86$, and MLU-morphemes, $F(3, 57) = 82.98$, $p = .001$, $d = 1.99$. In each case, post hoc comparisons indicated the main effect was due to the NIG group and FG group placed before 24 months significantly outperforming the other two groups. MLU and placement age were strongly correlated (MLU-words: $r = -.72$, $p = .001$, $d = 1.83$; MLU-morphemes: $r = -.72$, $p = .01$, $d = 1.74$).

Grammatical errors. All groups produced few grammatical errors. The mean number of errors for the NIG group and FG groups placed before and after 24 months were 2.4 (*SD* = 2.9), 2.4 (*SD* = 2.1),

and 2.7 (*SD* = 2.9), respectively. The IG group had an average of 4.5 errors (*SD* = 4.6). All errors were consistent with morphological omissions and number and gender errors found in typical development. As examples, instead of the adult target form of *Le pun p-astea* (I put these), one child used the singular pronoun, *O pun p-astea*. Another child produced *Ăla o împuşc* for *Pe ăla îl împuşc* (I shoot that one), omitting the preposition *pe* and using the incorrect gender of the pronoun *îl*.

Discussion

While children in both institutional and foster care continued to learn language from 30 to 42 months, the more typical environment of foster care affected language development in a profoundly positive way. Timing of foster placement was critical. Children placed in foster care by 24 months showed very improved language outcomes at 30 and 42 months. Children placed later had strikingly severe expressive and receptive delays, equal to those of children in institutional care. Both of these groups used mainly single words and phrases. This result accords very well with findings from other populations that the timing of early experience is a significant marker of language development (Werker & Tees, 2005).

The difference between language outcomes before and after 24 months should not obscure the overall correlation between placement age and outcomes. Unlike Croft et al.'s (2007) finding of no relation between school-age outcomes and duration of institutional care beyond 6 months, there were robust correlations between early language outcomes and age of foster placement. This graded effect of placement age on language outcomes parallels the finding for the children's cognitive skills (Nelson et al., 2007). For children with functional expressive output in institutional care and those placed in foster care after 24 months, the language deficit seems to be a severe delay rather than disorder. The children's expressive and receptive language was affected equivalently. Also, all groups produced very few grammatical errors, with all errors found in typical development. Although a purely nonverbal cognitive measure is necessary to confirm the results, the strong correlation between the language and cognitive measures suggests that the children's language skills align with their broader cognitive development.

The 30-month assessment occurred shortly after a substantial change in the care environment for children placed after 29 months. Thus, it is perhaps not surprising that this foster subgroup tended to show lower language performance than the children remaining in institutional care. At 42 months, this foster subgroup had spent a year in foster care but still had equivalent language outcomes to children in institutional care. Age of BEIP foster placement inherently is associated with the duration of both institutional and foster care; it is difficult to disambiguate these variables. However, the finding that foster children's language at 42 months was correlated strongly with 30-month outcomes suggests the significance of early language achievements. The result that children placed in foster care by 24 months had an equivalent MLU to the NIG group at 42 months contrasts with Windsor et al.'s (2007) 30-month finding that typical age peers had longer utterances. Although the group difference was not significant at 42 months, the foster children placed before 24 months did have slightly shorter utterances than the NIG group. Thus, there may be subtle expressive deficits even for foster children placed early.

Finally, while the foster care provided a broader range of experiences, it did not involve the focused language input and systematic responsiveness that characterize language intervention. Nonetheless, the randomized controlled trial gives significant weight to the importance of timing of early positive practices for facilitating young children's language development.

References

Bayley, N. (1993). *Bayley Scales of Infant Development–II*. San Antonio, TX: Psychological Corporation.

Bzoch, K. R., & League, R. (1971). *Assessing language skills in infancy*. Baltimore: University Park Press.

Cohen, N. J., Lojkasek, M., Zadeh, Z. Y., Pugliese, P., & Kiefer, H. (2008). Children adopted from China: A prospective study of their growth and development. *Journal of Child Psychology and Psychiatry*, *49*, 458–468.

Croft, C., Beckett, C., Rutter, M., Castle, J., Colvert, E., Groothues, C., et al. (2007). 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*, *48*, 31–44.

Devescovi, A., Caselli, M. C., Marchione, D., Pasqualetti, P., Reilly, J., & Bates, E. (2005). A crosslinguistic study of the relationship between grammar and lexical development. *Journal of Child Language*, *32*, 759–786.

Edwards, S., Fletcher, P., Garman, M., Hughes, A., Letts, C., & Sinka, I. (1997). *The Reynell Developmental Language Scales III*. Berkshire, UK: Nfer-Nelson.

Glennen, S. (2007). Predicting language outcomes for internationally adopted children. *Journal of Speech, Language, and Hearing Research*, *50*, 529–548.

Glennen, S., & Masters, M. G. (2002). Typical and atypical language development in infants and toddlers adopted from Eastern Europe. *American Journal of Speech-Language Pathology*, *11*, 417–433.

Hoksbergen, R, ter Laak, J., Rijk, K., van Dijkum, C., & Stoutjesdijk, F. (2005). Post-institutional autistic syndrome in Romanian adoptees. *Journal of Autism and Developmental Disorders*, *35*, 615–623.

Maclean, K. (2003). The impact of institutionalization on child development. *Development and Psychopathology*, *15*, 853–884.

Monachesi, P. (1999). The syntactic structure of Romanian auxiliary (and modal) verbs. In G. Bouma, E. W. Hinrichs, G. M. Kruijff, & R. T. Oehrle (Eds.), *Constraints and resources in natural language syntax and semantics* (pp. 101–117). Stanford, CA: Stanford University.

Morison, S. J., Ames, E. W., & Chisholm, K. (1995). The development of children adopted from Romanian orphanages. *Merrill-Palmer Quarterly*, *41*, 411–430.

Nelson, C. A., Zeanah, C. H., Fox, N. A., Marshall, P. J., Smyke, A. T., & Guthrie, D. (2007). Cognitive recovery in socially deprived young children: The Bucharest Early Intervention Project. *Science*, *318*, 1937–1940.

Roberts, J. A., Pollock, K. E., Krakow, R., Price, J., Fulmer, K. C., & Wang, P. P. (2005). Language development in preschool-age children adopted from China. *Journal of Speech, Language, and Hearing Research*, *48*, 93–107.

Rutter, M. & the English and Romanian Adoptees Study Team. (1998). Developmental catch-up, and deficit following adoption after severe global early privation. *Journal of Child Psychology and Psychiatry*, *39*, 465–476.

Rutter, M., Kreppner, J. M., & O'Connor, T. G. (2001). Specificity and heterogeneity in children's responses to profound institutional privation. *British Journal of Psychiatry*, *179*, 97–103.

Snedeker, J., Geren, J., & Shafto, C. (2007). Starting over: International adoption as a natural experiment in language development. *Psychological Science*, *18*, 79–87.

van IJzendoorn, M. H., Juffer, F., & Poelhuis, C. W. K. (2005). Adoption and cognitive development: A meta-analytic comparison of adopted and nonadopted children's IQ and school performance. *Psychological Bulletin*, *131*, 301–316.

Werker, J. F., & Tees, R. C. (2005). Speech perception as a window for understanding plasticity and commitment in language systems of the brain. *Developmental Psychobiology*, *46*, 233–234.

Windsor, J., Glaze, L. E., Koga, S. F., & the Bucharest Early Intervention Project Core Group. (2007). Language acquisition with limited input: Romanian institution and foster care. *Journal of Speech, Language, and Hearing Research*, *50*, 1365–1381.

Zeanah, C. H., Koga, S. F., Simian, B., Stanescu, A., Tabacaru, C. L., Fox, N. A., et al. (2006). Response to commentary: Ethical dimensions of the BEIP. *Infant Mental Health Journal*, *27*, 581–583.

Zeanah, C. H., Nelson, C. A., Fox, N. A., Smyke, A. T., Marshall, P., Parker, S. W., et al. (2003). Designing research to study the effects of institutionalization on brain and behavioral development: The Bucharest Early Intervention Project. *Development and Psychopathology*, *15*, 885–907.

Appendix

To calculate mean utterance length (MLU)-words, two coding decisions were needed. Auxiliaries and adjacent lexical verbs were considered one word (Monachesi, 1999). For example, *Ca să pun cănita aici* (So I will put the little cup here) was counted as four words, with the first person, future tense verb *să pun* being one word. Although Romanian pronominal enclitics are not considered separate lexical items, these enclitics sometimes were omitted by children and were credited with word status. For example, *Dă-mi cutitul* (Give me the knife) was considered three words.

Calculation of MLU-morphemes followed Devescovi et al.'s (2005) procedure for highly inflected languages. Adverbs, conjunctions, and interjections were each counted as one morpheme. An unmarked form was identified for other word classes; this unmarked form was counted as one morpheme with morphemes added for changes. Indefinite, singular nouns in the nominative or accusative case were unmarked, with morphemes added for marking the definite article as an enclitic, plurality, and genitive or dative case. Third-person singular pronouns in the nominative or accusative case were unmarked, with additional morphemes for differences in person, plurality, and genitive or dative case. The unmarked verb was third-person singular, present tense, with additional morphemes for person, plurality, and tense changes. Singular adjectives were unmarked; a morpheme was added for plurality. Gender typically was not marked differentially on adjectives but was assigned an additional morpheme when this occurred. As examples, *Tai căpşunele* (I cut the strawberries) had five morphemes: two for *tai* (first person singular verb, present tense) and three for *căpşunele* (definite plural noun). *Cu asta unde te duci?* (Where are you going with this?) had seven morphemes: one morpheme each for the preposition *cu*, singular adjective *asta*, and adverb *unde*; two for *te* (second-person pronoun, accusative case), and two for *duci* (second-person singular verb, present tense).