Published in final edited form as:
Twin Res Hum Genet. 2007 December ; 10(6): 840–847.

An Investigation of a Measure of Twins' Equal Environments

Karen S. Mitchell[1,2], **Suzanne E. Mazzeo**[1,3], **Cynthia M. Bulik**[4], **Steven H. Aggen**[2,5], **Kenneth S. Kendler**[2,5], and **Michael C. Neale**[2,5,6]

1 *Department of Psychology, Virginia Commonwealth University, Richmond, Virginia, United States of America*

2 *Virginia Institute for Psychiatric & Behavioral Genetics, Virginia Commonwealth University, Richmond, Virginia, United States of America*

3 *Department of Pediatrics, Virginia Commonwealth University, Richmond, Virginia, United States of America*

4 *Departments of Psychiatry and Nutrition, University of North Carolina at Chapel Hill, North Carolina, United States of America*

5 *Department of Psychiatry, Virginia Commonwealth University, Richmond, Virginia, United States of America*

6 *Department of Human Genetics, Virginia Commonwealth University, Richmond, Virginia, United States of America*

Abstract

The equal environments assumption, which holds that trait-relevant environments are equally correlated among monozygotic (MZ) and dizygotic (DZ) twin pairs, is essential to twin designs. Violations of this assumption could lead to biased parameter estimates in twin models. A variety of methods and measures have been used to test this assumption. No studies to date have evaluated the measurement invariance of such items or examined the distribution of the underlying equal environments trait. The current study was an investigation of the psychometric properties of a self-report measure of twins' equal environments. Exploratory and confirmatory factor analysis results indicated that items loaded onto 'child' and 'teen' equal environments factors. Factor loadings and factor variances and their covariance were invariant for MZ and DZ twins; however, DZ twins had significantly lower factor means than MZ twins. Further, these items demonstrated adequate test–retest reliability. Lastly, the child and teen factors may be bimodally distributed, particularly for MZ twin pairs. Measurement invariance issues, as well as distributions of equal environments traits, should be considered when evaluating the equal environments assumption, in order to produce accurate parameter estimates in twin models.

The equal environments assumption (EEA), which holds that trait-relevant environments are equally correlated among members of monozygotic (MZ) and dizygotic (DZ) twin pairs, is essential to twin study designs. Violations of the EEA could lead to biased parameter estimates; for example, if MZ twin environments that impact pair similarity for a given trait are more highly correlated than those of DZ twin pairs, estimates of the heritability of that trait would be inflated. Thus, this assumption has drawn criticism from the scientific community and given rise to investigations of its validity, using a variety of methods and measures. To date, most

Address for correspondence: Karen S. Mitchell, Department of Psychology, Virginia Commonwealth University, PO Box 842018, Richmond, VA 23284-2018. E-mail: s2ksmitc@vcu.edu.

empirical findings have suggested that violations of the EEA do not substantially bias estimates of heritability obtained from twin studies (Kendler et al., 1994; Loehlin & Nichols, 1976).

Questions remain regarding how best to measure the degree to which environments are shared between twins. Further, if members of MZ twin pairs have, or perceive that they have, more similar environments than DZ twin pairs, it may be reasonable to question whether measures of equal environments are invariant between these groups. Specifically, measurement invariance refers to whether an instrument is measuring the same construct in different groups. Discrepant factor loadings, item variances, or item means between groups can indicate measurement noninvariance (Meredith, 1983; Neale et al., 2005; Vandenberg, 2002; Vandenberg & Lance, 2000). Use of sum scores based on measures that do not assess the same construct in MZ and DZ twins could bias parameter estimates. For example, a mean difference in MZ versus DZ twin pairs' sum scores might be due to a genuine difference in the latent trait, or might be due to differences in a single errant item. Despite this, no findings regarding invariance of equal environments measures have been published.

In addition, many statistical modeling techniques assume that traits are normally distributed (e.g., Bollen, 1989), yet as in the case of EEA studies, this assumption often remains unexamined. We present a brief historical overview of measures of the EEA and results of the current investigation of the psychometric properties of a self-report measure of twins' equal environments, including measurement invariance, normality of the latent equal environments trait, and test-retest reliability analyses.

Perceived Versus True Zygosity

Several different measures of twins' equal environments have been used over the past 40 years. The earliest study of the EEA (Scarr, 1968) compared perceived zygosity, as reported by twins and their parents, and true zygosity, as assessed by the researchers, to provide a global test of the EEA. Specifically, this method, which assumes that parent treatment of twins is influenced by beliefs about their offsprings' zygosity, potentially assesses the impact of all environmental influences that are attributable to perceived zygosity. Kendler et al. (1993) later applied this concept to twin modeling, in which the variance of the trait was decomposed into additive genetic, common environmental, and unique environmental influences, as well as a form of family environment, which was specified according to twins' perceived zygosity. However, use of perceived zygosity as a measure of equal environments may be limited in its generality. Furthermore, those who persist in believing an incorrect zygosity classification may not be a random sample of the population of parents of twins.

Parent Report Measures of Twins' Environments

In an early investigation of the EEA, Loehlin and Nichols (1976) used survey items administered to parents in order to assess generic, observable similarities in the twin environment. This brief measure consisted of the following questions: 'were the twins dressed alike?', 'as children (ages 6–12) did the twins tend to play together or separately?', 'as adolescents (ages 12–18) did the twins tend to spend their time together?', 'did the twins have the same teacher in school?', 'did the twins sleep in the same rooms or separate rooms?', and '… in raising the twins which of these methods have you followed?' (*we have tried to treat them exactly the same; we tended to treat them alike; we have tried to treat them differently; we tended to treat them differently; at times we treated them alike, at other times, differently*). These investigators found that parents' beliefs about twin zygosity were not significantly correlated with their treatment of twins, suggesting that parents did not intentionally treat MZ twins more similarly than they treated DZ twins.

Kendler et al. (1994) investigated potential violations of the EEA with respect to psychiatric disorders, using parents' perceived zygosity of twins and reported child-rearing styles as measures of the environment. The child-rearing item assessed whether parents emphasized their twins' similarities or differences, or whether they emphasized both equally. Based on responses to this item, twin pairs were divided into five groups: nearly always emphasized similarity, usually emphasized similarity, equal, usually emphasized differences, and nearly always emphasized differences. The authors noted that the validity of perceived zygosity and retrospective self-report information as measures of equal environments may be somewhat limited; for example, parents' current perceptions of their twins may influence recall of their approach to child-rearing. Further, the directionality of the effect is unknown. Parents' more similar treatment of twins may influence twin resemblance, or the greater similarity in treatment may be due to similarity of the twins on the traits under study.

Twin Physical Similarity

Hettema et al. (1995) used physical similarity of twins as a measure of equal environments, noting that social environmental treatment of twins may be a function of appearance similarity. Their measure was based on ratings of photographs of the twins as adults. Similarity ratings of the photographs were highly correlated with twin- and parent-report measures of twin childhood similarity (Kendler et al., 1994). This measure of equal environments is somewhat limited however, as twin physical similarity is by nature highly associated with zygosity. Moreover, the photographs used to rate twin similarity were used in the algorithms which determined zygosity for some of the twin pairs; thus, it was not possible in this study to assess separately the effects of these two variables (Hettema et al., 1995).

Klump et al. (2000) extended the concept of physical similarity as a measure of equal environments by adding items thought to be relevant to the traits of interest. They combined observer ratings of twin photographs and ratings of body shape and body mass into a single index as an assessment of twins' equal environments with respect to measures of eating disordered attitudes and behaviors.

Twin Self-Report: Frequency of Contact

Another dimension relevant to the EEA is the frequency with which twins have contact with each other. Lykken et al. (1990) investigated whether increased contact leads to increased similarity or vice versa, using a single item assessing the frequency with which twins reported talking with their co-twin, either on the phone or in person (response options were: *we live together, daily, weekly, monthly, on holidays, seldom, and never*).

Similarly, two studies by Rose and colleagues (Rose et al., 1990; Rose et al., 1988) explored the effect of shared experiences on personality, with twins' report of social contact with each other as the equal environments measure. Participants were asked how long they lived with their co-twin, and how often they met or talked by telephone (response options ranged from *daily or almost daily* to *never*). Twins were classified according to whether they were living together, contacted each other daily, weekly, monthly, or had infrequent contact. These authors suggested that measuring equal environments would allow researchers to model its impact on traits of interest. Of course, the ability to do so in part depends on the type of measures used.

Kendler and Gardner (1998) investigated potential violations of the EEA using 12 items assessing the similarity of twins' childhood and adolescent experiences. The equal environments questions included Loehlin and Nichols' (1976) four items assessing the degree to which twins were dressed alike and shared the same room, class, and playmates, as children. Three additional questions investigated similarity of adolescent experiences: 'how often would you and your twin have the same friends', '… go around with the same group', and 'how often would your twin go out with you if you went to the movies or a dance?' In addition, twins were asked 'When you were growing up, were you emotionally closer to your twin than would be usual for ordinary sisters?' Response options ranged from *a lot closer* to *just about as close as ordinary sisters.* Another item asked, 'Some twins like to be as alike as possible in their dress, interests, and personality. Other twins like to be as different from one another as possible. When you and your twin were growing up, did you …?' Response options ranged from *always try to be as alike as possible* to *always try to be as different as possible*. The remaining three items assessed whether twins felt they were seen as individuals or as a pair by their parents, relatives and teachers, and friends and peers. Exploratory factor analysis of these 12 items yielded three factors: childhood treatment (sharing the same room and class and being dressed alike), co-socialization (sharing friends as teenagers, going around with the same group as teenagers, going on dates, and twins' emotional closeness), and similitude (how much twins' similarities were emphasized by parents, teachers, and friends and the item assessing how twins tried to be alike).

Summary

Numerous studies have investigated the validity of the EEA using a variety of measures, including perceived zygosity, twin and parent self-report of childhood treatment, and others' ratings of twin physical similarity. Despite evidence that MZ twins may have more similar environments than DZ twin pairs (e.g., Loehlin & Nichols, 1976), to our knowledge, measurement invariance, i.e., whether items assessing twins' environments measure the same construct in both MZ and DZ twin pairs, has not been investigated. In addition, few studies have assessed the reliability of such measures over time. Lastly, while statistical modeling techniques assume latent traits are normally distributed, this assumption is rarely tested. The current study investigated the factor structure, measurement invariance, and test-retest reliability of a self-report measure of twins' equal environments, as well as the distribution of the latent equal environments traits.

Method

Participants

The present study focuses on MZ (*n* = 368 pairs) and DZ (*n* = 252 pairs) female twins from the population-based Virginia Twin Registry (VTR; Kendler & Prescott, 1999), which now constitutes part of the Mid-Atlantic Twin Registry (MATR). This sample has been described in detail elsewhere (Kendler & Prescott, 2006).

Measures

The equal environments items used in the current study had been included in two waves of data from the VTR/MATR, including interviews conducted from 1992 to 1995 and a 1999 self-report questionnaire, which was mailed to participants (Neale, Mazzeo et al., 2003). Items (see Table 1) included the seven questions used in Kendler and Gardner's (1998), and Bulik et al.'s (1998) studies, which used previous waves of data from the VTR. These four items include the four child environment items based on Loehlin and Nichols' (1976) work, as well as the three additional teenage similarity items written by these investigators (Kendler & Gardner, 1998). Response options were coded on a 4-point scale, ranging from *never* (0) to *always* (4).

Statistical Analyses

Polychoric correlations, exploratory (EFA), and confirmatory (CFA) factor analyses were conducted using Mplus 4.1 (Muthén & Muthén, 1998–2006). The cluster option was used to account for the non-independence of the twin data. Of note, all factor analyses and tests of measurement invariance were conducted using data from the 1999 wave. Lastly, Mx (Neale, Boker et al., 2003) was used to assess the normality of the latent equal environments trait.

Results

Exploratory factor analysis—An EFA, using Promax rotation, was first conducted to examine the factor structure underlying the seven equal environments items (see Table 1 for a summary of factor loadings). Two factors with eigenvalues over 1.0 were extracted. The 2 correlated (r = .59) factors were labeled 'child' and 'teen.' Using a strict factor loading cutoff of .32 (Tabachnick & Fidell, 2001), two items were retained for the child factor, and three for the teen factor. Of the remaining two, one loaded equally well on both factors, and the second did not load satisfactorily on either factor. The retained child items were, 'When you were children, up to the age of 13, how often did you and your twin share the same room?' and 'When you were children, how often did you and your twin dress alike?' The three retained teen items, which all began with the stem 'As teenagers …' were '… how often would you and your twin have the same friends?', '… how often did you and your twin go around with the same group?', and '… how often would your twin go out with you if you went to the movies or a dance? 'However, two (the fifth and sixth) of these three items were found to be extremely highly correlated (r = .92), and, consequently, the completely standardized factor loading for the item '… how often did you and your twin go around with the same group?' was greater than 1.0. Therefore, this item was not retained for further analyses.

Confirmatory factor analysis—Next, a CFA was conducted to further investigate the 2-factor structure found for the equal environments items (see Table 2 for a summary of fit indices for all CFA models). All factor loadings were significant and high in magnitude (see Table 1). This model, with two factors (child and teen) and two items per factor (see Figure 1), was retained for subsequent measurement invariance analyses.

Measurement invariance—A series of model comparisons was conducted to determine whether the items measuring the two factors were invariant for MZ and DZ twin pairs. The baseline model (Model 1) was one in which factor loadings were estimated for each group, mean differences on factors were allowed for the two groups, and factor variances were constrained to unity for model identification. The first model for comparison (Model 2) equated the factor loadings while estimating variances and mean differences on factors. The weighted least squares means and variance adjusted (WSLMV) estimator in Mplus was used to fit the factor model to the ordinal item responses. A chi square difference cannot be directly obtained from the chi-square values obtained using WSLMV to test the significance of nested models. However, the DIFFTEST procedure provided in Mplus can be used to test for the statistical significance of nested models (Muthén & Muthén, 1998–2006). Results indicated that the factor loadings were not significantly different for DZs relative to MZs (p = .89). Therefore, Model 2 was used to compare a third model, with factor loadings and variances, as well as their covariance, equated in both groups while estimating factor mean differences. Results of the chi square difference test indicated that factor loadings, variances, and the covariance of the two factors were invariant for MZ and DZ twins (p = .06).

As this test was marginally significant, we explored further the potential differences between MZ and DZ twins. Comparing models which evaluated separately the invariance of factor variances and their covariance to Model 2 indicated that the factor covariance was equivalent for MZ and DZ twin pairs; however, factor variances were marginally significantly different (p = .05). Specifically, MZ twins (factor variance = .59) had higher variance for the child factor relative to DZ twins (factor variance = .24), but the DZ twins (factor variance = .76) had higher teen factor variance than did the MZ twins (factor variance = .64).

Lastly, Model 2 was compared to a fourth model which equated factor loadings and means, but allowed factor variances to be estimated separately. By default, Mplus sets the factor means of the first group, in this case the MZ twins, to zero and estimates the mean values for the second group relative to the first. Results of this model comparison suggested that, although factor loadings were equal across groups, factor means were significantly lower for DZs relative to MZs. Specifically, when the child mean was 0 for the MZ group, it was –.96 for the DZs; when the teen mean was 0 for the MZs, it was –1.06 for the DZ twins.

Temporal stability—Temporal stability was assessed by estimating polychoric correlations between equal environments items from Time 1 (1992–1995 interview wave) and Time 2 (1999 self-report questionnaire). In addition, across-time correlations between factor scores (obtained from Mplus) for the child and teen factors for both Time 1 and Time 2 were estimated. All item-level correlations were significant ($p < .01$) and ranged from .65 to .88 (see Table 3). Moreover, factor scores were highly correlated for both the child factors ($r = .75$, $p < .01$) and teen factors ($r = .68$, $p < .01$) for times 1 and 2.

Normality of the Equal Environments Latent Traits—As the EFA and CFA analyses yielded two equal environments traits, two separate models were estimated, using Mx, to evaluate the assumption that the child and teen latent equal environments traits were normally distributed in the population. Ordered latent class models (Schmitt et al., 2006) that make use of standardized Gauss-Hermite quadratures (Abramowitz & Stegan, 1972) can be used to test for latent non-normality. In this model, quadrature weights associated with fixed abscissae values can be used to test for departures from normality; these weights represent class membership probabilities. Item response probabilities are then computed, *conditional* on the position of the abscissae on the latent dimension. Normality of the latent trait can be tested by comparing two models, one where the ordered class memberships are fixed to approximate normality using Gaussian quadrature weights, and a second model where these weights are estimated from data. Since these models are nested, they can be compared statistically using a chi-square difference test; if significant, there is evidence that the latent trait does not follow a normal distribution.

Each factor had only two observed variables. In order to achieve identification, factor loadings were fixed to estimates obtained from the Mplus CFA (a model which estimated two latent factors, with a total of four factor loadings, four error variances, and one factor correlation) results. The comparison between models with the latent distribution of equal environment fixed to be normal (using Gaussian quadrature weights), and one with the weights freed, indicated that the distribution of the child latent trait was significantly non-normal ($\Delta\chi^2 = 30.14$, $\Delta df = 6$, $p < .05$). However, for the teen latent trait, there was no evidence of non-normality ($\Delta\chi^2 = 1.84$, $\Delta df = 6$, $p > .05$). As measurement invariance analyses indicated that factor means were significantly lower for DZs relative to MZs, these models were then conducted separately by zygosity. Results indicated that the child factor was non-normally distributed for both MZ ($\Delta\chi^2 = 16.39$, $\Delta df = 6$, $p < .05$) and DZ ($\Delta\chi^2 = 38.55$, $\Delta df = 6$, $p < .05$) twin pairs. However, the distribution of the teen factor was significantly non-normal for MZ twins ($\Delta\chi^2 = 14.25$, $\Delta df = 6$, $p < .05$) but normal for DZ twins ($\Delta\chi^2 = 5.91$, $\Delta df = 6$, $p > .05$). On inspection, the distributions of the child and teen (for MZs only) traits appear to be bimodal, suggesting that parents may fall into two main groups: those who tend to treat their twin children similarly, and those who do not. There remains, however, variability in treatment similarity within these two broad classifications.

Discussion

For the past nearly 40 years, twin studies have drawn criticism regarding the EEA. In response, behavior genetics researchers have sought to demonstrate the plausibility of this assumption.

A variety of methods have been used, including perceived zygosity of twins, parent and twin reports of childrearing, and physical similarity. Little evidence for violations of the EEA has been found (Loehlin & Nichols, 1976; Kendler et al., 1994). However, accurate measurement of this construct would allow the incorporation of equal environments into twin models (Rose et al., 1990) in order to account for its impact, thereby increasing confidence in parameter estimates. Measures of the similarity of twins' environments have inherent limitations, due to the richness and diversity of the construct of environmental influences. Investigation of the psychometric properties of such measures, including their factor structure and temporal stability, is useful for the evaluation of EEA violations. Further, tests of measurement invariance between MZ and DZ twins can provide valuable information regarding the quality and functioning of these measures.

Using self-report items designed to assess twins' equal environments, we extracted two factors, labeled 'child' and 'teen'. Of the seven original items, only four were found to load satisfactorily on the two factors. CFA confirmed the two-factor structure of the items, and this model was retained for measurement invariance analyses, comparing MZ and DZ twin pairs.

Measurement invariance results indicated that while factor loadings and the covariance of the two factors are invariant between groups, there was a difference in factor means between groups. Specifically, factor means were significantly lower for DZ twins relative to MZ twins. This finding is consistent with earlier research suggesting that MZ twins tend to be higher with regard to the similarity of their environments (e.g., Loehlin & Nichols, 1976). For example, it is likely that MZ twins would experience more similar behavior from others, given their physical appearance, which could increase their correlation for a given trait relative to DZ twins. This situation is not a violation of the EEA, however. The genetic factors for physical appearance can be seen as having a pleiotropic effect on the trait liability, which provides a pathway from genes to physical appearance to the behavior of others. Such pathways are referred to as the 'extended phenotype' (Dawkins, 1982). Furthermore, with respect to psychometric properties, differences in factor means (or variances) between MZ and DZ twins are not problematic (Neale et al., 2005), as such differences do not suggest that the items themselves are functioning differently in groups. We found a marginally significant difference between the factor variances of MZ and DZ twins. This result may prove more robust in a larger sample. When variances are noninvariant, it suggests that the group with the smaller variance is using a narrower range of the construct (Vandenberg & Lance, 2000). In this case, the DZ twins had a smaller child factor variance, and MZ twins had a smaller teen factor variance. Taken together, these results suggest that our measure of equal environments is measuring the same construct in MZ and DZ twins; however, DZ twins may have lower factor means relative to MZ twins, and the two groups differ in their use of the breadth of these constructs. Differences in factor means and variances indicate that two groups differ on a latent factor and are typically not cause for concern, as they are not due to idiosyncrasies of particular items (Neale et al., 2005). Thus, the results reported here suggest measurement invariance with respect to zygosity for the measure of equal environments described in the current study.

An additional consideration is that causal effects may go from the twins to their environment. In this case, known as an active gene × environment correlation (Plomin et al., 1977), what we call environmental similarity could be an outcome of genetic effects rather than a cause of bias. For example, a recent review of genetic influences on measures of the environment suggested that genetic factors accounted for significant proportions of variance (7%–39%) in these measures, including stressful life events, parenting, family environment, social support, peer interactions, and marital quality (Kendler & Baker, 2007).

Measurement is a potential limitation to all investigations of violations of the EEA, including that of the current study. A benefit to current behavioral genetic methodology is that we can model influences on variance component estimates of a given phenotype. However, our ability to do so is limited by the assessment of those influences, in this case, twins' equal environments. This construct is inherently difficult to assess, and there does not appear to be a consensus on the most appropriate items to include in such a scale. One possibility is that the items used to assess twins' equal environments should be those most relevant to a given phenotype, and would therefore differ for a given trait under study (e.g., Klump et al., 2000). For example, twin co-socialization (sharing friends as teenagers, going around with the same group as teenagers, going on dates, and twins' emotional closeness), contributed to resemblance for smoking initiation (Kendler & Gardner, 1998), as well as to bulimia nervosa (Bulik et al., 1998). As the average age of onset for both smoking and bulimia nervosa is during the teenage years, these equal environments items may be particularly relevant to these two traits.

Model comparison results suggested that while the teen equal environments trait appears to follow a normal distribution, the child trait was found to be significantly nonnormal and may have a bimodal distribution. This would suggest two somewhat distinct groups of parents: those who choose to treat their twins as being similar during childhood and those who do not, particularly for parents of MZs. This distinction may lessen as twins become teenagers and are more autonomous in choosing friends and whether to spend their free time together. Notably, distributions of different traits may differ for MZ and DZ twins. As many statistical modeling techniques assume traits are normally distributed, future EEA investigations should assess for, and take into account, violations of normality, in order to produce accurate parameter estimates.

The current study is limited by its use of a small set of self-report questionnaire items, which are designed to assess twins' equal environments. Moreover, each of the two factors identified using EFA had only two items with appropriately high factor loadings. Having so few items can cause identification problems, although that was not the case in subsequent confirmatory analyses.

This was the first study, to our knowledge, to investigate and test for measurement invariance of items designed to assess the equal environment assumption in MZ and DZ twin pairs, as well as the distribution of the underlying latent traits. Given our results, which indicated that factor means were significantly lower for DZ twins than for MZ twins, and that equal environments traits were not normally distributed, these issues should be considered when evaluating violations of the EEA. Future research should continue to develop and evaluate measures of twins' equal environments so that their impact on variance components can be more appropriately modeled.

Acknowledgements

This research was partially supported by National Institutes of Health Grants T32 MH20030 (KSM & MCN); K01 MH-068520-02 (SEM); R01 MH65322 (MCN); K01 MH001553 (CMB); and R01 DA-011287 & R01 MH-49492 (KSK).

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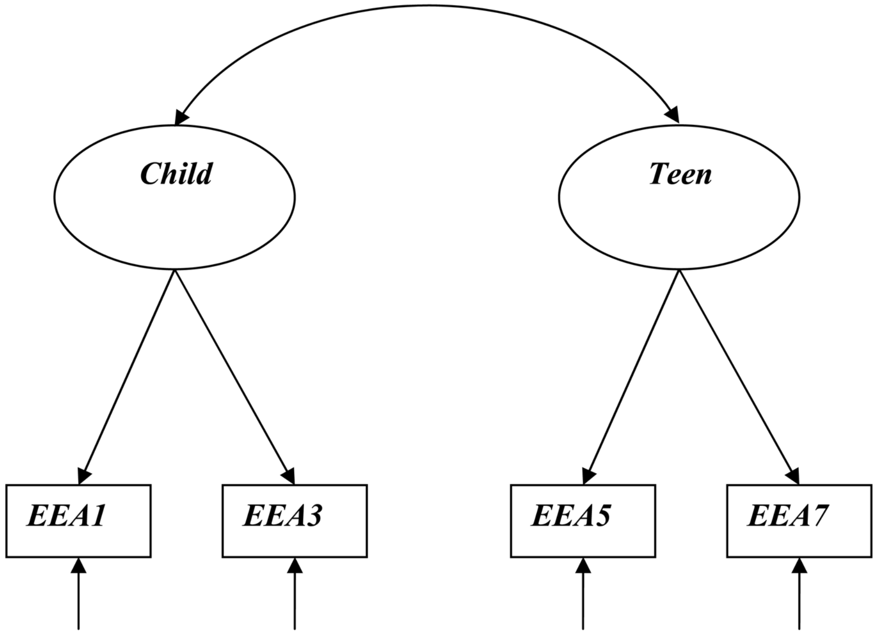

Figure 1.
Confirmatory factor analysis model for two correlated equal environments factors.

Table 1

Items and Exploratory and Confirmatory Factor Loadings

Item	EFA factor loadings		CFA factor loadings
	Child factor	Teen factor	
When you were children…			
EEA1: …up to the age of 13, how often did you and your twin share the same room?	**.85**	−.03	.84*
EEA2: …up to the age of 13, how often did you and your twin have the same playmates?	.36	.49	
EEA3: …how often did you and your twin dress alike?	**.90**	−.10	.83*
EEA4: …how often were you and your twin in the same class at school?	.30	.09	
As teenagers…			
EEA5: …how often would you and your twin have the same friends?	−.05	.96	.76*
EEA6: …how often did you and your twin go around with the same group?	−.06	1.02	
EEA7: how often would your twin go out with you if you went to the movies or a dance?	.14	**.70**	.94*

Note: EFA = exploratory factor analysis; CFA = confirmatory factor analysis

* denotes significant factor loadings

Table 2

Fit Indices for All Confirmatory Analyses

Model	χ^2	***Df***	**CFI**	**RMSEA**
Model 1: CFA with Λs estimated for both groups[a]	.01	1	1.0	.00
Model 2: Only Λs constrained	6.63	8	1.0	.00
Model 3: Λs, factor variances and covariance constrained	14.22	9	.99	.03
Model 4: Λs and means constrained	279.57	7	.64	.28

Note: λs = factor loadings.

[a]For the CFA model with all factor loadings estimated, Mplus fixes factor variances to 1.0 so that the model will be identified.

Table 3

Correlations Among Equal Environments Items at Time 1 and Time 2

	EEA1.1	EEA2.1	EEA3.1	EEA4.1	EEA5.1	EEA6.1	EEA7.1	EEA1.2	EEA2.2	EEA3.2	EEA4.2	EEA5.2	EEA6.2	EEA7.2
EEA1.1	1.0													
EEA2.1	.22	1.0												
EEA3.1	.35	.26	1.0											
EEA4.1	.21	.22	.37	1.0										
EEA5.1	.15	.65	.21	.21	1.0									
EEA6.1	.14	.56	.25	.19	.87	1.0								
EEA7.1	.12	.39	.18	.15	.57	.65	1.0							
EEA1.2	**.86**	.22	.36	.22	.14	.14	.09	1.0						
EEA2.2	.23	**.69**	.30	.26	.58	.55	.35	.33	1.0					
EEA3.2	.36	.23	**.80**	.37	.17	.18	.15	.42	.35	1.0				
EEA4.2	.23	.25	.39	**.88**	.23	.22	.13	.25	.32	.44	1.0			
EEA5.2	.18	.58	.24	.27	**.76**	.74	.51	.18	.68	.25	.32	1.0		
EEA6.2	.19	.54	.23	.21	.76	**.79**	.55	.18	.64	.22	.26	.92	1.0	
EEA7.2	.17	.39	.25	.19	.56	.60	**.65**	.15	.45	.25	.21	.68	.72	1.0

Note: Test–retest correlation coefficients are presented in bold type. Time point for equal environments items is indicated by a 1 or 2 to the right of the decimal point.