

# ACE Models with the NLSY

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## Abstract

We describe how to use the `NlsyLinks` package to examine various biometric models, using the NLSY79.

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## 1 Ambiguous twins

What are “ambiguous twins”?

MZ twins share all of the genetic information (*i.e.*,  $R = 1$ ), while DZ twins on average share half (*i.e.*,  $R = 0.5$ ). Sometimes a sibling pair doesn’t have enough information for us to classify comfortably as either MZ or DZ. We assign these “ambiguous twins”  $R = .75$ . Currently there are 13 ambiguous twins in the NLSY79C sample.

Of these 13 pairs, all had close birthdays and were the same gender. 12 pairs are ambiguous because the mother didn’t complete an NLSY survey since 1993; the first twin items were presented in 1994 (*e.g.*, R48257.00, and R48260.00). The mother of 13th pair (*i.e.*, subjects 864902 and 864903) simply avoided responding to the twin survey items.

Occasionally the mother of twins provided conflicting evidence. Fortunately, these mother were consistent among their most recent responses. For instance, Subjects 392401 and 392402 were indicated DZ in 1998, but MZ in 2000, 2002, and 2004. This pair was assigned  $R = 1$ .

Gen2 ambiguous twins can be viewed with:

```
> subset(Links79Pair, RelationshipPath=='Gen2Siblings' & R==.75)
```

	ExtendedID	Subject1Tag	Subject2Tag	R	RelationshipPath
1309	1460	146001	146002	0.75	Gen2Siblings
5013	5658	565901	565902	0.75	Gen2Siblings
6275	6639	663901	663902	0.75	Gen2Siblings
6665	7111	711101	711102	0.75	Gen2Siblings
7483	7913	791406	791407	0.75	Gen2Siblings
8436	8649	864902	864903	0.75	Gen2Siblings
9338	9596	959601	959602	0.75	Gen2Siblings

9725	10012	1001201	1001202	0.75	Gen2Siblings
10387	11191	1119103	1119104	0.75	Gen2Siblings
10435	11486	1148601	1148602	0.75	Gen2Siblings
10461	11733	1173301	1173302	0.75	Gen2Siblings
10462	11739	1173901	1173902	0.75	Gen2Siblings
11062	12574	1257402	1257403	0.75	Gen2Siblings

The 129 Gen2 siblings who are potentially twins or triplets can be similarly viewed with:

```
subset(Links79PairExpanded, RelationshipPath=='Gen2Siblings' & MultipleBirth != 'No')
```

## 2 Ambiguous siblings

What are “ambiguous siblings”?

Similar to ambiguous twins, ambiguous siblings are sibling pairs that we cannot comfortably classify as either full-siblings ( $R = .5$ ) or half-siblings ( $R = .25$ ). All siblings in the NLSY79-C/YA dataset share the same biological mother, so for these pairs, the problem is reduced to determining if they share the same biological father. There are two typical reasons for classifying siblings as ambiguous: (a) the relevant items are missing responses, or (b) the existing responses conflict with each other.

For instance, there are at least 173 Gen2 pairs where one sibling explicitly reported they shared a biological father, while the other sibling explicitly reported they did not. These subjects can be viewed with:

```
subset(Links79PairExpanded, RelationshipPath=='Gen2Siblings' &
  ((RExplicitOlderSibVersion==.5 & RExplicitYoungerSibVersion==.25)
  | (RExplicitOlderSibVersion==.25 & RExplicitYoungerSibVersion==.5)))
```

Another example occurs when a subject reports they are unsure or if their own responses are inconsistent over the years. These 69 Gen2 pairs can be viewed with:

```
subset(Links79PairExpanded, RelationshipPath=='Gen2Siblings' &
  (RExplicitOlderSibVersion==.375 | RExplicitYoungerSibVersion==.375))
```

When the one perspective provided inconclusive evidence of  $R$ , we looked at other perspectives to resolve their relationship.

## 3 Retaining vs. dropping the ambiguous twins and siblings

I am running ACE models with sibling pairs. Do you recommend including the pairs who are classified as  $R = .375$  or  $R = .75$ ? Or should I exclude them from the analyses?

This important issue touches Behavior Genetic concepts and modeling pragmatics. However, this issue typically has an easier resolution than it used to. In the links we released 10 years ago, there were 3,040 Gen2 pairs classified as ambiguous; in our current version, this has been reduced to 641. From one perspective, we are more likely to recommend dropping the ambiguous siblings because there are fewer of them (and therefore less potential gain by including them).

Here’s another perspective. Usually if they’re missing the data necessary to determine the  $R$  value, they’re also missing the phenotype, so they’d contribute very little to the analysis anyway. If there’s only a few in an  $R$  group, it may not be worth including them. Virtually none of the ambiguous twins have phenotype values for both Gen2 siblings.

Our advice to include/exclude an  $R$  group also depends on the kind of analysis. Some analyses break up the  $R$  values into separate categories (like multiple group SEMs). While some analyses treat  $R$  like a continuous variable (like DF analysis, or SEMs with constraint/definition variables). If you’re running the former, we’re more likely to recommend dropping small  $R$  groups, because they’re more likely to be estimated poorly (eg, the covariance matrix is more likely to misbehave). If you’re running the latter,

the estimation is more robust. (Though the estimation's robustness is a different issue than if that  $R$  group is a good representation).

We don't recommend blindly dropping the ambiguous twins and siblings in every analysis. For each scenario, the group sizes and phenotypic measurement issues should be considered.

We do recommend running a casual sensitivity test, at the very least. Run different models that include and exclude the small  $R$  groups. Hopefully the estimates change in expected ways (*e.g.*, including ambiguous siblings makes only a small difference) and you don't have to dig deeper. For all analyses, inspect each  $R$  group's covariance matrix, especially with for the MZs, which typically is the smallest group.

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