



TwinLife

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Documentation TwinLife Data: Zygoty

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1. Description of zygosity questionnaires and general procedure

For the determination of zygosity, a standardized parental-report (Goldsmith, 1991) was used in young twins (cohort 1 and 2) and a self-report questionnaire (Onisczenko et al., 1993) in adolescents and adult twins (cohort 3 and 4). For validation of these similarity based questionnaires via zygosity determination via DNA samples in the *TwinLife* project see Lenau et al. (2017).

Both questionnaires comprise questions on the twins' physical similarity (e.g. height, eye color, hair texture) and frequency of confusion of the twins by different relatives and others. In addition two questions about their own belief of zygosity and if they got information from medical staff whether they are identical or fraternal were assessed. Both questionnaires assessed 21 characteristics, but not each of the characteristics was used to determine zygosity (see appendix; p.4, p. 10): Fifteen characteristics were used for zygosity determination in cohort 1 and 2, seventeen were used in cohort 3 and 4. In general, greater similarities in physical characteristics such as height, eye color, hair texture and so on, should be found in monozygotic (MZ) twin pairs. However, physical differences should be found more often in dizygotic (DZ) twins. Therefore difference scores, calculated between twins within the pairs for each characteristic, should be smaller for MZ than for DZ twin pairs. Because of their greater physical similarity, MZ pairs are usually confused by other persons more often than DZ twins. Hence, the higher the frequency of confusion by others for a twin pair, the more likely it should be MZ.

In the *TwinLife* questionnaire program, parental-report should be given by one parent. This occurs in 991 of 1011 cases (98.0%). In 823 (81.4%) the questionnaire was answered by mothers, in 168 cases (16.6%) it was completed by fathers. In these 'normal' cases, the syntax for cohort 1 and 2 (see appendix, p.4ff) could be used as it is easily. In 20 cases (2.0%) the questionnaire was filled out by both parents (see p. 3 for the procedure in these cases).

The self-report questionnaire has to be filled out by both twins. This occurs in 987 of 991 cases (99.6%). In these 'normal' cases, the syntax for cohort 3 and 4 (see appendix, p. 10ff) could be used as it is easily. As both twins provided information about themselves and the co-twin, answers had to be compared within one person as well as between both twins. In the remaining 4 cases (0.4%) only one twin of a pair answered the questionnaire (see p. 3 for the procedure in these cases).

2. Discrepancies from the general procedure

Cohort 1 & 2: Zygosity questionnaire answered by both parents

In the following 20 cases zygosity questionnaire was answered by both parents:

| | | | | |
|--------------|--------------|--------------|--------------|--------------|
| fid = 115568 | fid = 117319 | fid = 128206 | fid = 148860 | fid = 151123 |
| fid = 154877 | fid = 163116 | fid = 166024 | fid = 173501 | fid = 185718 |
| fid = 188455 | fid = 196920 | fid = 227688 | fid = 249799 | fid = 259506 |
| fid = 262672 | fid = 268312 | fid = 274495 | fid = 290393 | fid = 299846 |

In these cases only the data provided by the mother were used for determination of zygosity to harmonize the source of information. Of course, discriminant function values are based on these data provided by mothers, too. If instead data provided by the father would be used in these 20 cases, this would result in different discriminant function values (zyg0109). In consequence, the determined zygosity would differ in the following three cases, if information provided by the father would have been used: fid = 117319, 128206 and 274495.

Cohort 3 & 4: Dealing with missing information

In four cases, the zygosity questionnaire was only filled out by one of the twins: fid = 370331, 379721, 422878 and 426745. In these cases, the given answers were duplicated, respectively reversed duplicated, to determine zygosity. Values were duplicated, if information was given about both twins, e.g., zyg1500 ("Have you been confused with one another in your childhood?"). Values were reversed duplicated, if persons were asked to provide separate information for themselves and their co-twin, e.g., zyg0200 („Own height“) und zyg0201 („Co-twins height“).

Cohort 3 & 4: Dealing with open-ended answers regarding twins eye colors

In cohort 3 and 4, both twins were asked to indicate their own and the co-twins eye colors (zyg1200 and zyg1202) in a closed-ended answer format (1 = 'blue', 2 = 'grey', 3 = 'light brown', 4 = 'dark brown', 5 = 'green') or in an open-ended format (6 = 'other color, namely').

If the open-ended format was used, responses were compared and recoded if necessary, resulting in two new eye color variables: zyg1205 and zyg1206. These variables contain the value 7 = 'equal', if the open-ended answers suggested a similar eye colors that was indicated by the co-twin. If answers indicate different eye colors, variable values were coded as 8 = 'different – twin1' or 9 = 'different – twin2'. Sometimes a clear classification based on open-ended answers as 'equal' or 'different' was not possible. In such cases the value 6 = 'other color, namely' was maintained.

Whether and which of these changes are realized is coded in the variable `zyg1207`: 1 = 'no change, no open-ended answer'; 2 = 'recoding results in greater similarity'; 3 = 'recoding results in smaller similarity'; 4 = 'no recoding, clear classification not possible'.

Zygoty determination was finally conducted with the new eye color variables (`zyg1205` and `zyg1206`). If instead the original eye color variables (`zyg1200` and `zyg1202`) would be used, the than calculated discriminant function values would differ from the present ones (`zyg0109`), if `zyg1207 = 2` or `zyg1207 = 3` (but not if `zyg1207 = 1` or `zyg1207 = 4`). For the following cases, recoding of open-ended answers resulted in a different estimation of zygoty compared to the original data: `fid = 317790, 388671, 412855, 464111` and `496742`.

EXPLANATORY NOTE: Independently of which eye color variables are used for zygoty determination, the value 6 = 'other color, namely' has to be coded as missing value!

3. Zygoty variables in the *TwinLife* dataset

Different zygoty variables can be found in the *TwinLife* dataset. First, there is the calculated zygoty, which results from similarity based questionnaire information (`zyg0100`). The discriminant function value (`zyg0109`) resulting from this procedure, is utilized as a cut-off value in the zygoty determination. The syntax used for this procedure could be found in the appendix.

TABLE 1: Overview about zygoty variables in the *TwinLife* dataset

| | |
|-----------------------------|--|
| <code>zyg0100</code> | = zygoty determined by questionnaire |
| <code>zyg0109</code> | = value of zygoty discriminant function |
| <code>zyg0101</code> | = zygoty determined by DNA test |
| <code>zyg0102</code> | = final zygoty variable zygoty determined by questionnaire information and corrected by result of the DNA test |
| <code>zyg0700</code> | = parents belief about twins zygoty (cohort 1 & 2) |
| <code>zyg0700_t</code> | = own belief about twins zygoty – twin1 (cohort 3 & 4) |
| <code>zyg0700_u</code> | = own belief about twins zygoty – twin2 (cohort 3 & 4) |

A DNA test was conducted by using saliva samples for a subsample ($N = 328$) of twin pairs in the *TwinLife* study. The result of this DNA test is coded in the variable named "`zyg0101`" for the subsample with coded missings for the remaining pairs of twins. If zygoty determined by using questionnaire information differed from the DNA based zygoty, the latter one was used. Therefore the zygoty determined by questionnaire information corrected for the result of the DNA test (`zyg0102`) should be used as the "*final zygoty variable*".

Furthermore, there are zygosity variables coding the parents (zyg0700) or twins (zyg0700_t, zyg0700_u) own belief about the twin's zygosity.

References

Goldsmith, H.H. (1991). A zygosity questionnaire for young twins: A research note. *Behavior genetics*, 21(3), 257-269. doi: 10.1007/BF01065819

Lenau, F., Hahn, E., Peters, A-L., Gottschling, J., Thiel, W., & Spinath, F. M. (2017). *Zygosity Determination in Twin Studies: A Validation of Zygosity Questionnaires Using DNA in the German TwinLife Study* (TwinLife Working Paper Series, 01). Bielefeld: Project TwinLife "Genetic and social causes of life chances" (Bielefeld University / Saarland University).

Oniszczenko, W., Angleitner, A., Strelau, J., & Angert, T. (1993). The questionnaire of twins' physical resemblance (Unpublished report). Warsaw, Poland: Department of Psychology, University of Warsaw.

Appendix

SPSS syntax to determine zygosity in cohort 1 & 2

* **Variable names**

| | | | | |
|------|---------------------------------------|---|-------------|---|
| 1.1 | Difference height ^x | = | diff_height | → Calculated from zyg0200t and zyg0200u |
| 1.2 | Difference hair texture | = | zyg0301 | |
| 1.3 | Difference eye color | = | zyg0302 | |
| 1.4 | Difference ear lobes | = | zyg0303 | |
| 1.5 | Difference blood type ^x | = | diff_blood | → Calculated from zyg0501 and zyg0503 |
| 1.6 | Difference Rhesus factor ^x | = | diff_rhesus | → Calculated from zyg0502 and zyg0504 |
| 1.7 | Difference hair color | = | zyg0300 | |
| 1.8 | Teeth at the same time | = | zyg0400 | |
| 1.9 | Similarity as grown older | = | zyg0602 | |
| 1.10 | Peas in a pod | = | zyg0809 | |
| 2.1 | Mistaken on photograph ^x | = | zyg0800 | |
| 2.2 | Mistaken when together | = | zyg0808 | |

Mistaken by

| | | | |
|-----|--|---|---------|
| 2.3 | ... people meeting first time | = | zyg0807 |
| 2.4 | ... babysitter | = | zyg0804 |
| 2.5 | ... other parent | = | zyg0801 |
| 2.6 | ... sibling | = | zyg0802 |
| 2.7 | ... close friends ^x | = | zyg0805 |
| 2.8 | ... casual friends | = | zyg0806 |
| 2.9 | ... other relatives | = | zyg0803 |
| 3.1 | Own belief | = | zyg0700 |
| 3.2 | Information medical staff ^x | = | zyg0702 |

Note:^x Assessed in the zygosity questionnaire, but not used for zygosity determination for cohorts 1 & 2.

* **Define missing values.**

Missing values

zyg0602 (1, -99 to -87)

zyg0807 zyg0804 zyg0801 zyg0802 zyg0806 zyg0803 (4, -99 to -87)

zyg0301 zyg0302 zyg0303 zyg0300 zyg0400 zyg0700 zyg0809 zyg0808 (-99 to -87).

Execute.

* **0 = DZ | 0.5 = Unsure | 1 = MZ**

- * **1.2 Difference hair texture (zyg0301) | 1.3 Difference eye color (zyg0302) |**
- 1.4 Difference ear lobes (zyg0303) | 1.7 Difference hair color (zyg0300)**
- * *Difference between twin1 and twin2 – Values: 1 'Clear difference', 2 'Small difference', 3 'No difference'*
 - *rated as MZ if 3 'No difference'*
 - *rated as DZ if 1 'Clear difference' or 2 'Small difference'*
 - *rated as 'Unsure' if missing value.*

Do repeat

p1 = zyg0301, zyg0302, zyg0303, zyg0300
/p2 = z_hairtexture, z_eyecolor, z_earlobes, z_haircolor.
+ Compute p2 = .5.
+ if (p1 eq 1 or p1 eq 2) p2 = 0.
+ if (p1 eq 3) p2 = 1.
+ if (missing(p1)) p2 = .5.

End repeat.

Execute.

- * **1.8 Teeth at the same time (zyg0400).**
- * *Values: 1 'Yes', 2 'Yes, same teeth on reverse sides', 3 'Yes, different teeth', 4 'No'*
 - *rated as MZ if 1 'Yes' or 2 'Yes, same teeth on reverse sides'*
 - *rated as DZ if 3 'Yes, different teeth' or 4 'No'*
 - *rated as 'Unsure' if missing value.*

Compute z_teeth = .5.

if (zyg0400 eq 1 or zyg0400 eq 2) z_teeth = 1.
if (zyg0400 eq 3 or zyg0400 eq 4) z_teeth = 0.
if (missing(zyg0400)) z_teeth = .5.

Execute.

- * **1.9 Similarity as grown older (zyg0602)**
- * *Values: 1 'remained the same', 2 'decreases', 3 'increases'*
 - *rated as MZ if 3 'increases'*
 - *rated as DZ if 2 'decreases'*
 - *rated as 'Unsure' if 1 'remained the same'.*

Compute z_similarity = .5.

if (zyg0602 eq 2) z_similarity = 0.
if (zyg0602 eq 3) z_similarity = 1.
if (missing (zyg0602)) z_similarity =.5.

Execute.

*** 1.10 Peas in a pod (zyg0809)**

* *Similarity in early childhood - Values: 1 'Like peas in a pod', 2 'Such as siblings', 3 'Unlike'*

- *rated as MZ if 1 'Like peas in a pod'*
- *rated as DZ if 2 'Such as siblings' or 3 'Unlike'*
- *rated as 'Unsure' if missing value.*

Compute z_peas = .5.

- if (zyg0809 eq 1) z_peas = 1.
- if (zyg0809 eq 2 or zyg0809 eq 3) z_peas = 0.
- if (missing(zyg0809)) z_peas = .5.

Execute.

*** 2.2 Mistaken when together (zyg0808)**

* *Values: 1 'Often', 2 'Sometimes', 3 'Almost never', 4 'Never'*

- *rated as MZ if 1 'Often' or 2 'Sometimes'*
- *rated as DZ if 3 'Almost never' or 4 'Never'*
- *rated as 'Unsure' if missing value.*

Compute z_together = .5.

- if (zyg0808 eq 1 or zyg0808 eq 2) z_together = 1.
- if (zyg0808 eq 3 or zyg0808 eq 4) z_together = 0.
- if (missing(zyg0808)) z_together = .5.

Execute.

*** Mistaken by 2.3 ... people meeting first time (zyg0807)**

* *Values: 1 'Often', 2 'Sometimes', 3 'rarely or never', 4 'Non-existent person'*

- *rated as MZ if 1 'Often'*
- *rated as DZ if 2 'Sometimes' or 3 'rarely or never'*
- *rated as 'Unsure' if 4 'Non-existent person' (= missing value).*

Do repeat

- p1 = zyg0807
- /p2 = z_first.
- + Compute p2 = .5.**
- + if (p1 eq 1) p2 = 1.
- + if (p1 eq 2 or p1 eq 3) p2 = 0.
- + if (missing(p1)) p2 = .5.

End repeat.

Execute.

* **Mistaken by 2.4 ... babysitter (zyg0804) | 2.5 ... other parent (zyg0801) | 2.6 ... sibling (zyg0802) | 2.8 ... casual friends (zyg0806) | 2.9 ... other relatives (zyg0803)**

* Values: 1 'Often', 2 'Sometimes', 3 'rarely or never', 4 'Non-existent person'
→ rated as MZ if 1 'Often' or 2 'Sometimes'
→ rated as DZ if 3 'rarely or never'
→ rated as 'Unsure' if 4 'Non-existent person'.

Do repeat

p1 = zyg0804, zyg0801, zyg0802, zyg0806, zyg0803
/p2 = z_sitter, z_parent, z_sibling, z_casual, z_relative.

+ Compute p2 = .5.
+ if (p1 eq 1 or p1 eq 2) p2 = 1.
+ if (p1 eq 3) p2 = 0.
+ if (missing(p1)) p2 = .5.

End repeat.

Execute.

* **3.1 Own belief (zyg0700)**

* Values: 1 'MZ, pretty sure', 2 'MZ, probable', 3 'DZ, probable', 4 'DZ, pretty sure'
→ rated as MZ if 1 'MZ, pretty sure' or 2 'MZ, probable'
→ rated as DZ if 3 'DZ, probable' or 4 'DZ, pretty sure'
→ rated as 'Unsure' if 3 'I don't know'.

Compute z_own = .5.

if (zyg0700 eq 1) z_own = 1.
if (zyg0700 eq 2) z_own = .75.
if (zyg0700 eq 3) z_own = .25.
if (zyg0700 eq 4) z_own = 0.
if (missing(zyg0700)) z_own = .5.

Execute.

* **Definition of formats.**

Formats

z_hairtexture, z_eyecolor, z_earlobes, z_haircolor, z_teeth, z_similarity, z_peas,
z_together, z_first, z_sitter, z_parent, z_sibling, z_casual, z_relative, z_own (f1).

Execute.

*** Discriminant function.**

** Discriminant function analysis identified two relevant functions, which are used for zygosity determination.*

Compute K12_function1 =

| | | |
|----------------|---|-------------|
| z_hairtexture | * | 0.9537399 |
| + z_eyecolor | * | 6.5841776 |
| + z_earlobes | * | 2.3434223 |
| + z_haircolor | * | 4.2267694 |
| + z_teeth | * | 2.1001529 |
| + z_similarity | * | 6.1666692 |
| + z_peas | * | 3.3475087 |
| + z_together | * | 6.0811228 |
| + z_first | * | 1.1352624 |
| + z_sitter | * | 3.8778887 |
| + z_parent | * | -0.1736023 |
| + z_sibling | * | 3.8537521 |
| + z_casual | * | 2.3726814 |
| + z_relative | * | 2.1931398 |
| + z_own | * | 4.3887034 |
| | | -19.4375035 |

Execute.

Compute K12_function2 =

| | | |
|----------------|---|------------|
| z_hairtexture | * | -0.1835516 |
| + z_eyecolor | * | 3.3501305 |
| + z_earlobes | * | -0.8558546 |
| + z_haircolor | * | 0.4727857 |
| + z_teeth | * | 1.1929617 |
| + z_similarity | * | 3.5175963 |
| + z_peas | * | -0.9177389 |
| + z_together | * | 4.9043226 |
| + z_first | * | 1.0278555 |
| + z_sitter | * | 3.7237434 |
| + z_parent | * | -0.5826957 |
| + z_sibling | * | 3.5679306 |
| + z_casual | * | -0.1018220 |
| + z_relative | * | 1.7975445 |
| + z_own | * | -0.5725689 |
| | | -5.1441262 |

Execute.

- * **Zygoty determination by comparing the values of both discriminant functions.**
- * **In the dataset the variable "Zygoty" is named "zyg0100"!**

Compute Zygoty = 0.

If (K12_function1 gt K12_function2) Zygoty = 1.

If (K12_function1 le K12_function2) Zygoty = 2.

Execute.

Value Labels

Zygoty 1'MZ' 2'DZ'.

Execute.

- * **Alternative – Zygoty determination by comparing only one discriminant function value with zero (as in Cohort 3 & 4).**

- * **In the dataset the variable "K12_function" is named "zyg0109"!**

Compute

K12_function = K12_function1 - K12_function2.

Execute.

Compute Zygoty = 0.

If (K12_function le 0) Zygoty = 2.

If (K12_function gt 0) Zygoty = 1.

Execute.

Value Labels

Zygoty 1 'MZ' 2 'DZ'.

Execute.

*****.

SPSS syntax to determine zygosity in cohort 3 & 4

* Variable names

| | | | |
|-------------|--|------------------|--|
| 1.1 | Difference height | = diff_height | → Calculated from zyg0200t, zyg0201t, zyg0200u, zyg0201u |
| 1.2 | Difference hair texture | = diff_texture | → Calculated from zyg1100t, zyg1100u |
| 1.3 | Difference eye color | = diff_eyes | → Calculated from zyg1204t, zyg1204u |
| 1.4 | Difference ear lobes | = diff_ears | → Calculated from zyg1300t, zyg1300u |
| 1.5 | Difference blood type | = diff_blood | → Calculated from zyg0501t, zyg0503t, zyg0501u, zyg0503u |
| 1.6 | Difference Rhesus factor ^x | = diff_rhesus | → Calculated from zyg0502t, zyg0504t, zyg0502u, zyg0504u |
| 1.7 | Difference hairiness | = diff_hairiness | → Calculated from zyg1101t, zyg1102t, zyg1101u, zyg1102u |
| 1.8 | Difference eye color – calculated from eye colors | = diff_eye | → Calculated from zyg1205t, zyg1206t, zyg1205u, zyg1206u |
| 1.9 | Difference sweating | = diff_sweat | → Calculated from zyg1600t, zyg1601t, zyg1600u, zyg1601u |
| 1.10 | Difference skin color | = diff_skin | → Calculated from zyg1400t, zyg1401t, zyg1400u, zyg1401u |
| 1.11 | Difference sickness | = diff_sick | → Calculated from zyg1700t, zyg1700u |
| 2.1 | Mistaken on photograph | = photo | → Calculated from zyg1507t, zyg1507u |
| 2.2 | Ever mistaken | = mistaken | → Calculated from zyg1500t, zyg1500u |
| Mistaken by | | | |
| 2.3 | ... people meeting first time | = first | → Calculated from zyg1505t, zyg1505u |
| 2.4 | ... teacher | = teacher | → Calculated from zyg1504t, zyg1504u |
| 2.5 | ... parents | = parents | → Calculated from zyg1501t, zyg1501u |
| 2.6 | ... sibling | = siblings | → Calculated from zyg1502t, zyg1502u |
| 2.7 | ... friends ^x | = friends | → Calculated from zyg1503t, zyg1503u |
| 2.8 | Effort to keep apart | = effort | → Calculated from zyg1506t, zyg1506u |
| 3.1 | Own belief ^x | = own | → zyg01800t, zyg1800u |
| 3.2 | Information medical staff ^x | = medical | → zyg1801t, zyg1801u |

Note:^x Assessed in the zygosity questionnaire, but not used for zygosity determination for cohorts 3 & 4.

* Define missing values.

Missing Values

zyg0200t zyg0201t zyg0501t zyg0503t zyg1100t zyg1101t zyg1102t zyg1204t zyg1300t
zyg1400t zyg1401t zyg1507t zyg1500t zyg1501t zyg1502t zyg1504t zyg1505t zyg1506t
zyg1600t zyg1601t zyg1700t (-99 to -87)
zyg0200u zyg0201u zyg0501u zyg0503u zyg1100u zyg1101u zyg1102u zyg1204u zyg1300u
zyg1400u zyg1401u zyg1507u zyg1500u zyg1501u zyg1502u zyg1504u zyg1505u zyg1506u
zyg1600u zyg1601u zyg1700u (-99 to -87)
zyg1205t zyg1206t (-99 to -87, 6)
zyg1205u zyg1206u (-99 to -87, 6).

Execute.

```

*****
* 0 = DZ | 0.5 = Unsure | 1 = MZ
*****

* 1.1 Difference height
* Difference height twin1 (diff_height.t) = Height self (zyg0200t) minus height twin2 (zyg0201t).

Compute
  diff_height.t = abs(zyg0200t - zyg0201t).
Execute.

* Rated as MZ if difference smaller than 2 cm
* Rated as DZ if difference greater than 2 cm
* Rated as 'Unsure' if missing height twin1 or twin2.

Compute z_height.t = 0.
  if (diff_height.t le 2) z_height.t = 1.
  if (missing(diff_height.t)) z_height.t = .5.
Execute.

*****
* Difference height twin2 (diff_height.u) = Height self (zyg0200u) minus height twin1 (zyg0201u).

Compute
  diff_height.u = abs(zyg0200u - zyg0201u).
Execute.

* Rated as MZ if difference smaller than 2 cm
* Rated as DZ if difference greater than 2 cm
* Rated as 'Unsure' if missing height twin1 or twin2.

Compute z_height.u = 0.
  if (diff_height.u le 2) z_height.u = 1.
  if (missing(diff_height.u)) z_height.u = .5.
Execute.

*****
* Comparison of z_height.t and z_height.u.

Compute diff_height = 0.
  if ((z_height.t eq 1 and z_height.u eq 1)
  or (z_height.t eq 1 and z_height.u eq .5)
  or (z_height.t eq .5 and z_height.u eq 1)) diff_height = 1.
  if ((z_height.t eq 1 and z_height.u eq 0)
  or (z_height.t eq 0 and z_height.u eq 1)
  or (z_height.t eq .5 and z_height.u eq .5)) diff_height = .5.
Execute.

```

*****.

* **Comparison of the self-rated heights of twin1 and twin2, if zyg0201t and zyg0201u is missing.**

If (missing(zyg0201t) and missing(zyg0201u)
and abs(zyg0200t - zyg0200u) le 2) diff_height = 1.

Execute.

*****.

* **1.2 Difference hair texture (zyg1100t, zyg1100u) | 1.3 Difference eye color (zyg1204t, zyg1204u) | 1.4 Difference ears lobes (zyg1300t, zyg1300u) | 2.2 Ever mistaken (zyg1500t, zyg1500u) | 2.8 Effort to keep apart (zyg1506t, zyg1506u)**

→ rated as MZ if 1 'No difference'

→ rated as DZ if 2 'Small difference' or 3 'Clear difference'

→ rated as 'unsure' if both is missing, or unequal answers of both twins
(1 'No difference' vs. 2 'Small difference' or 3 'Clear difference').

Do repeat

p1 = zyg1100t, zyg1204t, zyg1300t, zyg1500t, zyg1506t
/p2 = zyg1100u, zyg1204u, zyg1300u, zyg1500u, zyg1506u
/p3 = diff_texture, diff_eyes, diff_ears, mistaken, effort.

+ Compute p3 = 0.

+ If ((p1 eq 1 and p2 eq 1)
or (p1 eq 1 and missing(p2))
or (missing(p1) and p2 eq 1)) p3 = 1.

+ If ((p1 eq 1 and p2 ge 2)
or (p1 ge 2 and p2 eq 1)
or (missing(p1) and missing(p2))) p3 = .5.

End repeat.

Execute.

*****.

* **1.5 Difference blood type (diff_blood) | 1.7 Difference Hairiness (diff_hairiness) | 1.8 Difference eye color, calculated (diff_eye) | 1.9 Difference sweating (diff_sweat) | 1.10 Difference skin color (diff_skin)**

→ rated as MZ if report about the own and twins characteristic is the same

→ rated as DZ if report about the own and twins characteristic is different

→ rated as 'unsure' if either the own or twins characteristic is missing.

Do repeat

p1 = zyg0501t, zyg0501u, zyg1101t, zyg1101u, zyg1205t, zyg1205u,
zyg1600t, zyg1600u, zyg1400t, zyg1400u
/p2 = zyg0503t, zyg0503u, zyg1102t, zyg1102u, zyg1206t, zyg1206u,
zyg1601t, zyg1601u, zyg1401t, zyg1401u
/p3= diff_blood.t, diff_blood.u, diff_hairiness.t, diff_hairiness.u, diff_eye.t, diff_eye.u,
diff_sweat.t, diff_sweat.u, diff_skin.t, diff_skin.u.

+ Compute p3 = 0.

+ if (p1 eq p2) p3 = 1.

+ if (missing(p1) or missing(p2)) p3 = .5.

End repeat.

Execute.

*****.

*** Comparison of the difference scores of twin1 and twin2.**

Do repeat

p1 = diff_blood.t, diff_hairiness.t, diff_eye.t, diff_sweat.t, diff_skin.t
/p2 = diff_blood.u, diff_hairiness.u, diff_eye.u, diff_sweat.u, diff_skin.u
/p3 = diff_blood, diff_hairiness, diff_eye, diff_sweat, diff_skin.

+ Compute p3 = 0.

+ if ((p1 eq 1 and p2 eq 1)
or (p1 eq 1 and p2 eq .5)
or (p1 eq .5 and p2 eq 1)) p3 = 1.
+ if ((p1 eq 1 and p2 eq 0)
or (p1 eq 0 and p2 eq 1)
or (missing(p1) and missing(p2))
or (p1 eq .5 and p2 eq .5)) p3 = .5.

End repeat.

Execute.

*****.

*** Comparison of the self-rated characteristics of twin1 and twin2.**

Do repeat

p1 = zyg0501t, zyg1101t, zyg1205t, zyg1600t, zyg1400t
/p2 = zyg0501u, zyg1101u, zyg1205u, zyg1600u, zyg1400u
/p3 = zyg0503t, zyg1102t, zyg1206t, zyg1601t, zyg1401t
/p4 = zyg0503u, zyg1102u, zyg1206u, zyg1601u, zyg1401u
/p5 = diff_blood, diff_hairiness, diff_eye, diff_sweat, diff_skin.

+ if (missing(p3) and missing(p4) and p1 eq p2) p5 = 1.

End repeat.

Execute.

*****.

*** 1.11 Difference sickness (zyg1700t, zyg1700u)**

*** Sick as often as the twin sibling - Values: 1 'Yes', 2 'No'**

→ rated as MZ if 1 'Yes'

→ rated as DZ if 2 'No'

→ rated as 'unsure' if both is missing, or unequal answers of both twins

(1 'Yes' vs. 2 'No').

Compute diff_sick = 0.

if ((zyg1700t eq 1 and zyg1700u eq 1)
or (zyg1700t eq 1 and missing(zyg1700u))
or (missing(zyg1700t) and zyg1700u eq 1)) diff_sick = 1.
if ((zyg1700t eq 1 and zyg1700u eq 2)
or (zyg1700t eq 2 and zyg1700u eq 1)
or (missing(zyg1700t) and missing(zyg1700u))) diff_sick = .5.

Execute.

*** 2.1 Mistaken on photograph (zyg1507t, zyg1507u).**

- * Easy to keep twins apart on a photograph - Values: 1 'Yes', 2 'Yes, with difficulties', 3 'No'
 - rated as MZ if 3 'No'
 - rated as DZ if 1 'Yes' or 2 'Yes, with difficulties'
 - rated as 'unsure' if both is missing, or unequal answers of both twins (3 'No' vs. 1 'Yes' or 2 'Yes, with difficulties').

Compute photo = 0.

```
if ((zyg1507t eq 3 and zyg1507u eq 3)
or (zyg1507t eq 3 and missing(zyg1507u))
or (missing(zyg1507t) and zyg1507u eq 3)) photo = 1.
if ((zyg1507t lt 3 and zyg1507u eq 3)
or (zyg1507t eq 3 and zyg1507u lt 3)
or (missing(zyg1507t) and missing(zyg1507u))) photo = .5.
```

Execute.

*** Mistaken by 2.3 ...people meeting first time (zyg1505t, zyg1505u) |
2.4 ...teacher (zyg1504t, zyg1504u) | 2.5 ...parents (zyg1501t, zyg1501u) |
2.6 ...sibling (zyg1502t, zyg1502u).**

- * Recode variable values for zyg1505t, zyg1504t, zyg1501t, zyg1502t as a 3 point scale is needed.

Recode zyg1505t (4 = 3).

Recode zyg1504t (4 = 3).

Recode zyg1501t (4 = 3).

Recode zyg1502t (4 = 3).

Execute.

Value Labels

zyg1505t, zyg1504t, zyg1501t, zyg1502t, 1 'Often' 2 'Sometimes' 3 'Rarely/never'.

Execute.

- * Recode variable values for zyg1505u, zyg1504u, zyg1501u, zyg1502u as a 3 point scale is needed.

Recode zyg1505u (4 = 3).

Recode zyg1504u (4 = 3).

Recode zyg1501u (4 = 3).

Recode zyg1502u (4 = 3).

Execute.

Value Labels

zyg1505u, zyg1504u, zyg1501u, zyg1502u, 1 'Often' 2 'Sometimes' 3 'Rarely/never'.

Execute.

*****.

* *Fixing zyg1505t, zyg1504t, zyg1501t and zyg1502t as 3 'Rarely/never', if 2.2 Ever mistaken (zyg1500t) is answered with 2 'No'.*

Do repeat

p1 = zyg1505t, zyg1504t, zyg1501t, zyg1502t.
+ if (zyg1500t eq 2 and missing(p1)) p1 = 3.

End repeat.

Execute.

* *Fixing zyg1505u, zyg1504u, zyg1501u and zyg1502u as 3 'Rarely/never', if 2.2 Ever mistaken (zyg1500t) is answered with 2 'No'.*

Do repeat

p1 = zyg1505u,zyg1504u, zyg1501u, zyg1502u.
+ if (zyg1500u eq 2 and missing(p1)) p1 = 3.

End repeat.

Execute.

*****.

* *Two variants to deal with the mistaken-by-questions.*

*****.

* **Variant 1**

- *rated as MZ if 1 'Often'*
- *rated as DZ if 2 'Sometimes' or 3 'Rarely/never'*
- *rated as 'unsure' if both is missing, or unequal answers of both twins (1 'Often' vs. 2 'Sometimes' or 3 'Rarely/never').*

Do repeat

p1 = zyg1505t, zyg1504t, zyg1501t, zyg1502t
/p2 = zyg1505u, zyg1504u, zyg1501u, zyg1502u
/p3 = first1, teacher1, parents1, siblings1.

+ Compute p3 = 0.

+ if ((p1 eq 1 and p2 eq 1)
or (p1 eq 1 and missing(p2))
or (missing(p1) and p2 eq 1)) p3 = 1.
+ if ((p1 eq 1 and p2 ge 2)
or (p1 ge 2 and p2 eq 1)
or (missing(p1) and missing(p2))) p3=.5.

End repeat.

Execute.

*****.

*** Variant 2**

- rated as MZ if 1 'Often' or 2 'Sometimes'
- rated as DZ if 3 'Rarely/never'
- rated as 'unsure' if both is missing, or unequal answers of both twins (1 'Often' or 2 'Sometimes' vs. 3 'Rarely/never').

Do repeat

p1 = zyg1505t, zyg1504t, zyg1501t, zyg1502t
/p2 = zyg1505u, zyg1504u, zyg1501u, zyg1502u
/p3 = first2, teacher2, parents2, siblings2.

+ Compute p3 = 0.

- + if ((p1 le 2 and p2 le 2)
or (p1 le 2 and missing(p2))
or (missing(p1) and p2 le 2)) p3 = 1.
- + if ((p1 le 2 and p2 gt 2)
or (p1 gt 2 and p2 le 2)
or (missing(p1) and missing(p2))) p3=.5.

End repeat.

Execute.

*****.

*** Definition of formats.**

Formats

diff_height, diff_texture, diff_eyes, diff_ears, mistaken, effort, diff_blood, diff_hairiness,
diff_eye, diff_sweat, diff_skin, diff_sick, photo, first1, teacher1, parents1, siblings1, first2,
teacher2, parents2, siblings2 (F3.1).

Execute.

*** Discriminant function.**

Compute K34_function =

diff_height * 0.1897978
+ diff_texture * 0.5605866
+ diff_eyes * 0.5238624
+ diff_ears * 0.1673749
+ diff_blood * 0.2258757
+ diff_hairiness * 0.5772032
+ diff_eye * 0.4635317
+ diff_sweat * 0.4227721
+ diff_skin * 0.3399911
+ diff_sick * 0.1145348
+ photo * 0.2645853
+ mistaken * 0.5259179
+ first1 * 1.2050446
+ teacher1 * 0.6979019
+ teacher2 * 0.2221294
+ parents2 * 0.1033330
+ siblings1 * 0.4642417
+ effort * 0.1521250
- 4.1798810 .

Execute.

- * *Zygosity determination by comparing the discriminant function value with zero.*
- * *In the dataset the variable "K34_function" is named "zyg0109"!*
- * *In the dataset the variable "Zygosity" is named "zyg0100"!*

Compute Zygosity = 0.

If (K34_function le 0) Zygosity = 2.
If (K34_function gt 0) Zygosity = 1.

Execute.

Value Labels

Zygosity 1 'MZ' 2 'DZ'.

Execute.
