# Self-Conscious Emotions in Sport and Exercise: Relationships of Implicit and Explicit Processes of Authentic and Hubristic Pride and Physical Activity

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# Abstract

Self-conscious emotions play a crucial role in sports and exercise by reflecting self-related goal achievements. Traditionally, these emotions are explained through explicit attributional processes. However, implicit processes that influence self-related goal orientation are often overlooked.

*Keywords*: keyword1, keyword2, keyword3

# Self-Conscious Emotions in Sport and Exercise: Relationships of Implicit and Explicit Processes of Authentic and Hubristic Pride and Physical Activity

[1] 0

# Note

In this section, all data are automatically generated from the R code. You can access the full code [here](https://github.com/Enno-W/Self-Conscious-Emotions-in-Sport-and-Exercise/blob/main/index.qmd)

# Study 1

## Participants

Participants were adults with specific goals (e.g., running a marathon, competing in a triathlon, aesthetics, bodybuilding) and/or pre-defined workout routines (e.g., running routine, weight training log). A sample size calculation using G*Power29 for testing one-sided point biserial correlation with |ρ| = .5, α = .05, and 1 – β = .95 indicated a necessary sample size of N = 34. As an incentive, participants were offered feedback on their results and suggestions for improving their workout routine motivation. Ultimately, the sample consisted of* N\* = 23 recreational athletes (mean age = 36.13 years, SD = 14.17), including 14 females, 7 males, and 2 identifying as diverse. Participants followed individual workout routines averaging 7.69 hours per week (SD = 4.29) with a self-rated intensity (perceived exertion) of 5.17 (SD = 1.47). The sports they engaged in included running (n = 10), triathlon (n = 6), weight training (n = 4), and other endurance sports (n = 3).

## Measures

(see article)

## Procedure

(see article)

## Analysis

First, implicit motives for achievement, affiliation, and power motives were z-standardized, motive components were gender balanced t-standardized and the entire data was checked for normal distribution. Applying the Shapiro-Wilk test, session training distance (*p* = 0.001), session training duration (*p* = 0.002) and perceived rate of exhaustion (*p* = 0.002) as well as fear of rejection (*p* = 0.004) were not normally distributed. We then calculated the speed from the time and distance values for each session, and found that there was a great variety. As a consequence, we grouped the data into three categories that fit with common speed of swimming, running, and cycling. If the speed was less than five kilometers per hour, the session was regarded as “swimming”, less than 20 kilometers per hour as “running”, and more than 20 kilometers per hour as “cycling”. We then z-standardised the session distance within these respective groups. After this, the running distance was normally distributed (*p* = 0.05) Second, descriptive statistics were calculated. Third, according to the small sample size and normally distributed variables, Spearman rank correlations were calculated. For the analysis, the programming language R ([R Core Team, 2024](#ref-rlanguage2024)) was used.

## Results

Correlations are shown in [Figure 1](#fig-corrplot).

# Study 2

## Analysis

We excluded participants manually if they reported data on less than two training sessions, if they did not participate in a structured training programme, or if they were neither runners nor triathletes. Subsequent analyses were performed using the R language ([R Core Team, 2024](#ref-rlanguage2024)). A reproducible version of the results section of this article is available at https://github.com/Enno-W/Self-Conscious-Emotions-in-Sport-and-Exercise.

The baseline kilometer variable were standardized within their respective sport group, that is, running vs. triathlon. 17 of data were missings. Since most of the incomplete date was due to training sessions that were not completed, we decided against multiple imputation, following the reccomendations of [Lit]. Descriptive statistics were calculated for all variables - descriptive statistics - correlation

We used the nlme-package ([Pinheiro et al., 2024](#ref-nlme)) for the hierarchical linear models. The time-varying predictors pride and positive affect were group-mean centered, and the stable predictors attribution style (globality, dynamics, locus) and implicit motives (achievement, affiliation, power) were grand mean centered. This procedure entangles the between-person-effects from the within-person-effects. This is in line with recommendations of Wang and Maxwell ([2015](#ref-Wang2015)). They authors emphasize that a within-person effect can be present regardless of the between-person-effect, and vice versa. To illustrate this, it is possible that within a person, a lack of pride after a run predicts a greater running distance in the next session. At the same time, people who less proud on average do not necessarily run more.

The results for the hierarchical linear models are presented separately for each the dependent variables of this study: Session distance, session duration and rate of perceived exhaustion. We used interaction terms of pride with positive affect, causal attribution and implicit motives to predict these dependent variables. The predictors were added to the null model in three steps: First, the interaction term of pride and positive affect, second, the interaction terms of pride and attribution styles, and third, interaction terms of pride and implicit motives. We then decided on the appropriate model based on fit indices and explanatory power, and then checked for three statistical assumptions: the absence of multicollinearity, homoscedasticity, and the normal distribution of residuals. We also assessed if a correlation matrix improved the model fit.

## Participants

## Measures

(see article)

## Procedure

(see article)

## Results

## Session distance

In this model, we used interaction terms of pride with positive affect, causal attribution and implicit motives to predict running distance. The running distance was z-standardized to allow a comparison between the kilometer values reported by swimmers, runners, and triathlets. To allow We added predictors to the null model in three steps: First, the interaction term of pride and positive affect, second, the interaction terms of pride and attribution styles, and third, interaction terms of pride and implicit motives. The result is shown in [Table 2](#tbl-hlmtable_km).

The residuals were normally distributed (*p* = 0.11 ). [Figure 4](#fig-sessionkm_assumptions) shows the deviation from the normal distribution along with the distribution of residuals. The latter should show no pattern, since this would indicate that there are predictors unaccounted for. While this seems to be the case, the residuals are slightly skewed to the left, indicating limited variance in the kilometer variable.

## Session duration

In this model, we used interaction terms of pride with positive affect, causal attribution and implicit motives to predict running distance. The running distance was z-standardized to allow a comparison between the kilometer values that triathletes reported, and those that were reported by runners. We added predictors to the null model in three steps: First, the interaction term of pride and positive affect, second, the interaction terms of pride and attribution styles, and third, interaction terms of pride and implicit motives. The result is shown in [Table 3](#tbl-hlmtable_h).

The residuals were normally distributed (*p* = 0.32 ). [Figure 5](#fig-sessionh_assumptions) shows the deviation from the normal distribution along with the distribution of residuals. The latter should show no pattern, since this would indicate that there are predictors unaccounted for. While this seems to be the case, the residuals are slightly skewed to the left, indicating limited variance in the kilometer variable.

## Session Rate of Perceived Exhaustion

The regression coefficients are shown in [Table 3](#tbl-hlmtable_h). The third model with all predictors shows the lowest AIC and log likelihood. To account for the possible autocorrelation of repeated measurements, we employed an autoregressive process of order 1 (AR(1)) correlation structure using the corAR1 class from the nlme package in R. This structure was used to model the correlation between observations that are sequentially related in time. However, this did not result in a better model fit ( *p* = 0.84), so we used the model without the correlation structure (Model 3).

A more stable attribution style predicted a lower RPE, and so did the interaction terms of pride with positive affect, pride with a more external locus of control, pride with a higher implicit affiliation as well as a higher power motive. Only the interaction between pride and the implicit achievement motive predicted a higher rate of perceived exhaustion for each session.

The residuals were normally distributed in a Kolmogorov-Smirnov test (*p* = 0.13 ). This test is less sensitivie to small deviations from the norm [LIT]. [Figure 3](#fig-sessionrpe_assumptions) shows the deviation from the normal distribution in a QQ-Plot along with the distribution of residuals. The linear patterns that emerge in the residuals are a result of the discrete values in the session RPE data.

To assess multicollinearity, we computed the variance influence factor which ranged from *vifmin* = 1.09 to *vifmax* = 2.72.

The marginal and conditional R-squared values, representing the portion of variance explained by the fixed effects and the random effects respectively, were *R2marginal* = 0.3208527 and *R2conditional* = 0.5277259.

Table 1

The Table Caption

|  | **Correlations** | | | | | | | | | | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Measure** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | **15** | **16** | **17** | **18** | **19** |
| 1. Pride |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2. Hubris | 0.07 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 3. Session Training Distance | 0.06 | 0.25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 4. Session Training Hours | 0.19 | -0.45\* | 0.13 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 5. Session Training RPE | 0.28 | 0.23 | 0.06 | -0.03 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 6. Positive Affect | 0.64\*\* | 0.08 | -0.03 | 0.04 | 0.18 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 7. Negative Affect | -0.05 | 0.41 | -0.14 | -0.06 | 0.22 | 0.04 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 8. Achievement | 0.12 | -0.15 | 0.11 | 0.48\* | -0.24 | -0.12 | -0.04 |  |  |  |  |  |  |  |  |  |  |  |  |
| 9. Affiliation | 0.04 | 0.12 | 0.23 | 0.41 | -0.2 | -0.02 | 0.35 | 0.41 |  |  |  |  |  |  |  |  |  |  |  |
| 10. Power | 0.06 | 0.36 | 0.48\* | 0.13 | 0.21 | -0.14 | 0.19 | 0.48\* | -0.01 |  |  |  |  |  |  |  |  |  |  |
| 11. Hope for Success | 0.46 | -0.07 | -0.55\* | -0.01 | 0.1 | 0.21 | -0.11 | -0.17 | -0.26 | -0.2 |  |  |  |  |  |  |  |  |  |
| 12. Fear of Failure | -0.09 | 0.11 | -0.23 | -0.18 | 0.03 | -0.06 | 0.29 | 0.2 | 0.13 | 0.26 | 0.05 |  |  |  |  |  |  |  |  |
| 13. Hope for Belonging | 0.35 | 0.21 | 0.18 | 0.07 | -0.12 | 0.12 | -0.18 | 0.25 | 0.03 | 0.13 | 0.11 | 0.17 |  |  |  |  |  |  |  |
| 14. Fear of Rejection | -0.44 | 0.23 | -0.37 | -0.26 | -0.09 | -0.41 | 0.26 | -0.05 | 0.17 | 0.06 | 0.19 | 0.26 | -0.32 |  |  |  |  |  |  |
| 15. Hope for Control | -0.08 | -0.17 | 0.04 | 0.23 | -0.15 | -0.39 | -0.48\* | 0.04 | -0.31 | -0.04 | 0.06 | 0.17 | 0.38 | -0.17 |  |  |  |  |  |
| 16. Fear of Loss of Control | -0.07 | -0.02 | -0.23 | -0.32 | -0.08 | -0.14 | 0.1 | -0.05 | 0.04 | -0.07 | 0.16 | 0.64\* | 0.09 | 0.16 | -0.15 |  |  |  |  |
| 17. Locus | 0.12 | -0.26 | -0.54\* | 0.18 | -0.04 | 0.36 | -0.3 | 0.04 | -0.03 | -0.34 | 0.45 | 0.03 | -0.02 | 0.15 | 0.05 | 0.1 |  |  |  |
| 18. Dynamics | 0.01 | -0.11 | -0.2 | 0.35 | -0.18 | -0.15 | 0.16 | 0.01 | 0.34 | -0.22 | 0.18 | -0.28 | 0.01 | 0.07 | -0.21 | 0.27 | 0.18 |  |  |
| 19. Controllability | -0.04 | 0.35 | 0.24 | -0.29 | 0.19 | -0.06 | 0.48\* | -0.13 | -0.09 | 0.33 | -0.24 | 0.24 | 0.29 | -0.27 | -0.13 | 0 | -0.77\*\* | -0.16 |  |

*Note*. The note below the table.

# Discussion

The variance influence factors suggest low multicollinearity (for a discussion see [O’brien, 2007](#ref-Obrien2007)), which is also evident from the correlation table.

## Limitations and Future Directions

## Conclusion

# References

O’brien, R. M. (2007). A caution regarding rules of thumb for variance inflation factors. *Quality &Amp; Quantity*, *41*(5), 673–690. <https://doi.org/10.1007/s11135-006-9018-6>

Pinheiro, J., Bates, D., & R Core Team. (2024). *Nlme: Linear and nonlinear mixed effects models*. <https://CRAN.R-project.org/package=nlme>

R Core Team. (2024). *R: A language and environment for statistical computing*. R Foundation for Statistical Computing. <https://www.R-project.org/>

Wang, L. (Peggy)., & Maxwell, S. E. (2015). On disaggregating between-person and within-person effects with longitudinal data using multilevel models. *Psychological Methods*, *20*(1), 63–83. <https://doi.org/10.1037/met0000030>

Table 2

Hierarchical Linear Model Coefficients Predicting Running Distance

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Nullmodell | | Model 1 | | Model 2 | | Model 3 | |
| (Intercept) | 0.02 | (0.15) | -0.03 | (0.17) | 0.05 | (0.19) | -0.02 | (0.19) |
| Pride |  |  | 0.22 | (0.46) | -0.36 | (0.64) | -0.48 | (0.68) |
| Positive Affect |  |  | -0.01 | (0.33) | 0.22 | (0.38) | 0.31 | (0.37) |
| Dynamics |  |  |  |  | -0.20 | (0.29) | -0.39 | (0.30) |
| Locus |  |  |  |  | 0.01 | (0.27) | 0.17 | (0.30) |
| Globality |  |  |  |  | -0.05 | (0.13) | -0.10 | (0.14) |
| Affiliation |  |  |  |  |  |  | 0.00 | (0.04) |
| Achievement |  |  |  |  |  |  | -0.01 | (0.05) |
| Power |  |  |  |  |  |  | 0.03 | (0.06) |
| Pride × Dynamics |  |  |  |  | 1.34 | (1.06) | 1.92 | (1.07) |
| Pride × Positive Affect |  |  | 0.60 | (0.81) | 0.02 | (0.94) | -0.17 | (0.98) |
| Pride × Locus |  |  |  |  | -0.31 | (0.50) | -1.02 | (0.61) |
| Pride × Globality |  |  |  |  | 0.20 | (0.38) | -0.09 | (0.43) |
| Pride × Affiliation |  |  |  |  |  |  | -0.17 | (0.11) |
| Pride × Achievement |  |  |  |  |  |  | 0.16 | (0.11) |
| Pride × Power |  |  |  |  |  |  | -0.25 | (0.13) |
| nobs | 59 |  | 59 |  | 59 |  | 57 |  |
| nobs.1 | 59.00 |  | 59.00 |  | 59.00 |  | 57.00 |  |
| sigma | 0.79 |  | 0.80 |  | 0.83 |  | 0.77 |  |
| logLik | -75.40 |  | -75.60 |  | -75.39 |  | -76.99 |  |
| AIC | 156.79 |  | 163.20 |  | 174.78 |  | 189.98 |  |
| BIC | 163.02 |  | 175.24 |  | 197.48 |  | 220.82 |  |
| deviance | 150.79 |  |  |  |  |  |  |  |
| df.residual | 42.00 |  | 39.00 |  | 36.00 |  | 32.00 |  |
| \*\*\* p < 0.001; \*\* p < 0.01; \* p < 0.05. | | | | | | | | |

*Note*. Time varying predictors Pride and Positive Affect were cluster-mean-centered, fixed predictors were grand mean centered. In Model 4, the dependent variable was log-transformed to address heteroscedasticity and normality of residues. The fit indices of Model 4 are not directly comparable to models 1-3.

Table 3

Hierarchical Linear Model Coefficients Predicting Running Time

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Nullmodell | | Model 1 | | Model 2 | | Model 3 | |
| (Intercept) | **4.22 \*\*\*** | **(0.13)** | **4.20 \*\*\*** | **(0.14)** | **4.26 \*\*\*** | **(0.14)** | **4.21 \*\*\*** | **(0.14)** |
| Pride |  |  | -0.25 | (0.30) | -0.28 | (0.30) | -0.30 | (0.28) |
| Positive Affect |  |  | -0.11 | (0.24) | -0.13 | (0.24) | -0.12 | (0.22) |
| Dynamics |  |  |  |  | -0.19 | (0.20) | -0.36 | (0.21) |
| Locus |  |  |  |  | -0.19 | (0.22) | -0.04 | (0.24) |
| Globality |  |  |  |  | 0.00 | (0.11) | -0.04 | (0.12) |
| Affiliation |  |  |  |  |  |  | 0.03 | (0.04) |
| Achievement |  |  |  |  |  |  | 0.01 | (0.05) |
| Power |  |  |  |  |  |  | 0.04 | (0.05) |
| Pride × Dynamics |  |  |  |  | -0.08 | (0.30) | 0.37 | (0.32) |
| Pride × Positive Affect |  |  | 0.16 | (0.23) | -0.23 | (0.27) | **-0.61 \*** | **(0.28)** |
| Pride × Locus |  |  |  |  | -0.54 | (0.28) | **-1.02 \*\*** | **(0.31)** |
| Pride × Globality |  |  |  |  | -0.40 | (0.23) | **-0.65 \*\*** | **(0.23)** |
| Pride × Affiliation |  |  |  |  |  |  | -0.10 | (0.07) |
| Pride × Achievement |  |  |  |  |  |  | **0.25 \*\*\*** | **(0.07)** |
| Pride × Power |  |  |  |  |  |  | -0.16 | (0.09) |
| nobs | 77 |  | 77 |  | 77 |  | 72 |  |
| nobs.1 | 77.00 |  | 77.00 |  | 77.00 |  | 72.00 |  |
| sigma | 0.67 |  | 0.64 |  | 0.62 |  | 0.58 |  |
| logLik | -87.57 |  | -87.57 |  | -86.71 |  | -85.84 |  |
| AIC | 181.14 |  | 187.13 |  | 197.42 |  | 207.68 |  |
| BIC | 188.18 |  | 200.88 |  | 223.88 |  | 244.13 |  |
| deviance | 175.14 |  |  |  |  |  |  |  |
| df.residual | 58.00 |  | 55.00 |  | 52.00 |  | 45.00 |  |
| \*\*\* p < 0.001; \*\* p < 0.01; \* p < 0.05. | | | | | | | | |

*Note*. Time varying predictors Pride and Positive Affect were cluster-mean-centered, fixed predictors were grand mean centered. In Model 4, the dependent variable was log-transformed to address heteroscedasticity and normality of residues. The fit indices of Model 4 are not directly comparable to models 1-3.

Table 4

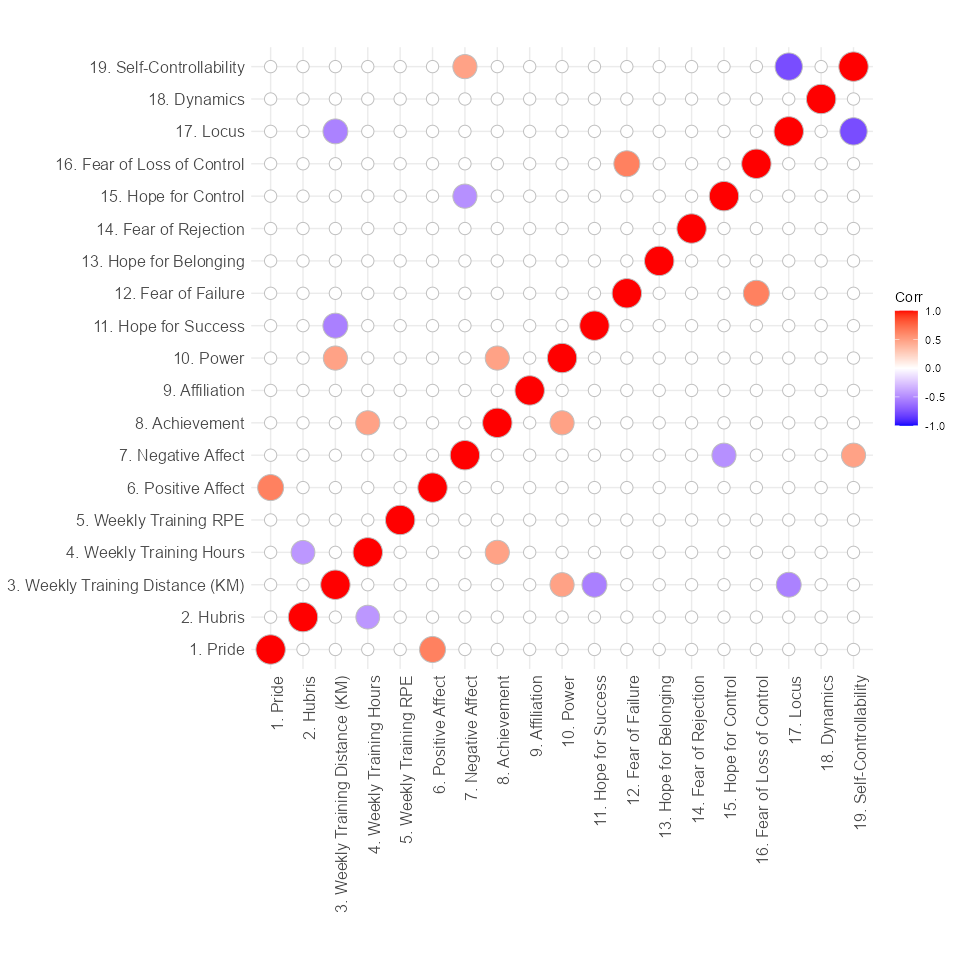
Hierarchical Linear Model Coefficients Predicting Session Rate of Perceived Exhaustion

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Nullmodell | | Model 1 | | Model 2 | | Model 3 | |
| (Intercept) | **5.17 \*\*\*** | **(0.30)** | **5.28 \*\*\*** | **(0.32)** | **5.35 \*\*\*** | **(0.30)** | **5.42 \*\*\*** | **(0.36)** |
| Pride |  |  | -0.61 | (0.82) | -1.24 | (0.81) | -1.39 | (0.80) |
| Positive Affect |  |  | -0.95 | (0.66) | -0.91 | (0.64) | -0.81 | (0.63) |
| Dynamics |  |  |  |  | **-1.19 \*\*** | **(0.40)** | **-1.38 \*** | **(0.52)** |
| Locus |  |  |  |  | 0.22 | (0.44) | 0.27 | (0.58) |
| Globality |  |  |  |  | 0.17 | (0.22) | 0.26 | (0.29) |
| Affiliation |  |  |  |  |  |  | 0.03 | (0.09) |
| Achievement |  |  |  |  |  |  | -0.10 | (0.11) |
| Power |  |  |  |  |  |  | -0.00 | (0.12) |
| Pride × Dynamics |  |  |  |  | -1.36 | (0.80) | -0.05 | (0.90) |
| Pride × Positive Affect |  |  | -0.87 | (0.62) | **-1.41 \*** | **(0.69)** | **-2.10 \*\*** | **(0.77)** |
| Pride × Locus |  |  |  |  | -1.18 | (0.74) | **-2.70 \*\*** | **(0.87)** |
| Pride × Globality |  |  |  |  | 1.07 | (0.61) | 0.42 | (0.65) |
| Pride × Affiliation |  |  |  |  |  |  | **-0.52 \*** | **(0.20)** |
| Pride × Achievement |  |  |  |  |  |  | **0.54 \*\*** | **(0.19)** |
| Pride × Power |  |  |  |  |  |  | **-0.49 \*** | **(0.24)** |
| nobs | 78 |  | 77 |  | 77 |  | 72 |  |
| nobs.1 | 78.00 |  | 77.00 |  | 77.00 |  | 72.00 |  |
| sigma | 1.82 |  | 1.76 |  | 1.68 |  | 1.64 |  |
| logLik | -163.77 |  | -157.41 |  | -149.08 |  | -142.80 |  |
| AIC | 333.54 |  | 326.83 |  | 322.17 |  | 321.59 |  |
| BIC | 340.61 |  | 340.57 |  | 348.62 |  | 358.05 |  |
| deviance | 327.54 |  |  |  |  |  |  |  |
| df.residual | 59.00 |  | 55.00 |  | 52.00 |  | 45.00 |  |
| \*\*\* p < 0.001; \*\* p < 0.01; \* p < 0.05. | | | | | | | | |

*Note*. Time varying predictors Pride and Positive Affect were cluster-mean-centered, fixed predictors were grand mean centered. In Model 4, the dependent variable was log-transformed to address heteroscedasticity and normality of residues. The fit indices of Model 4 are not directly comparable to models 1-3.

Figure 1

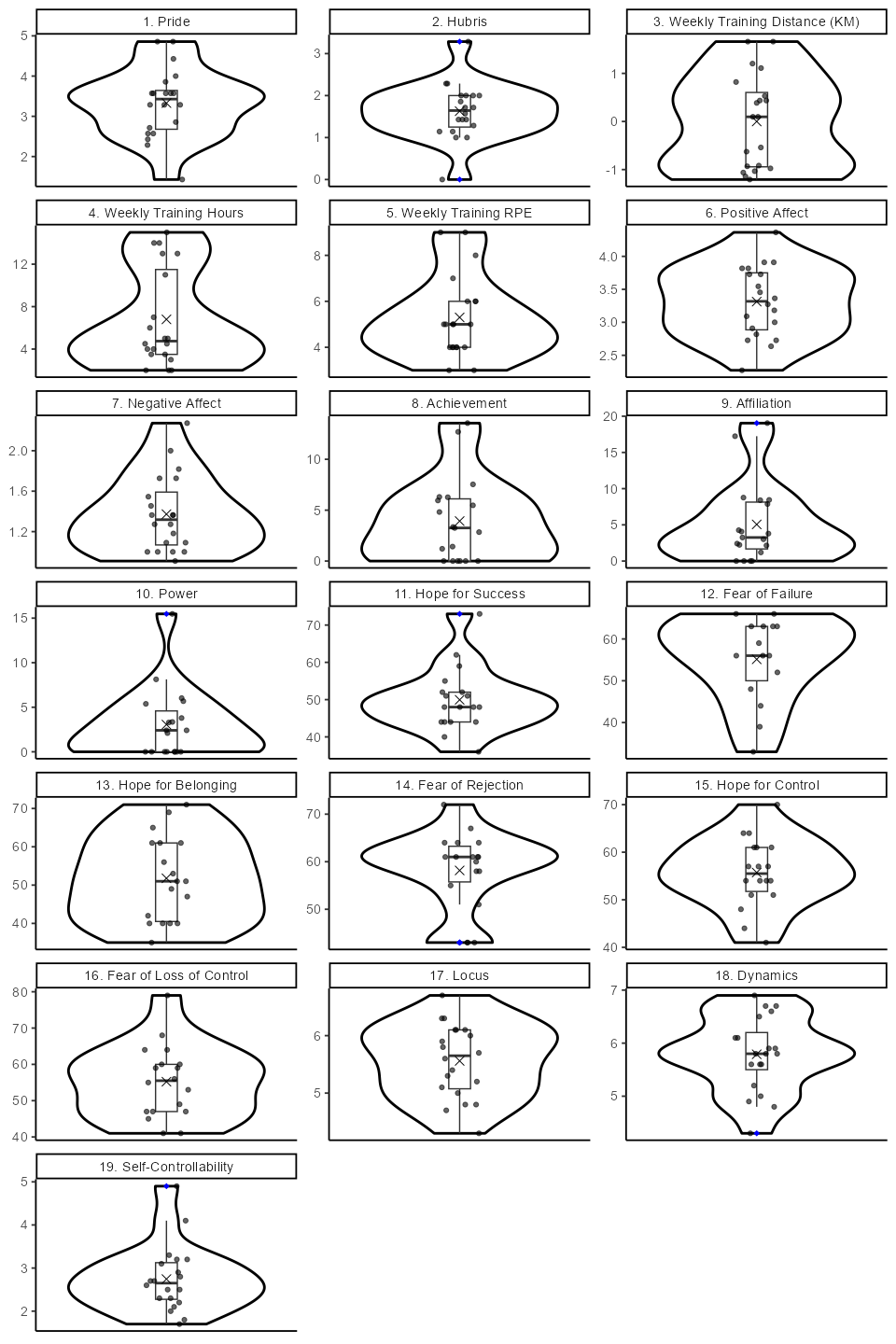
Heatmap



*Note*. This is the note below the figure.

Figure 2

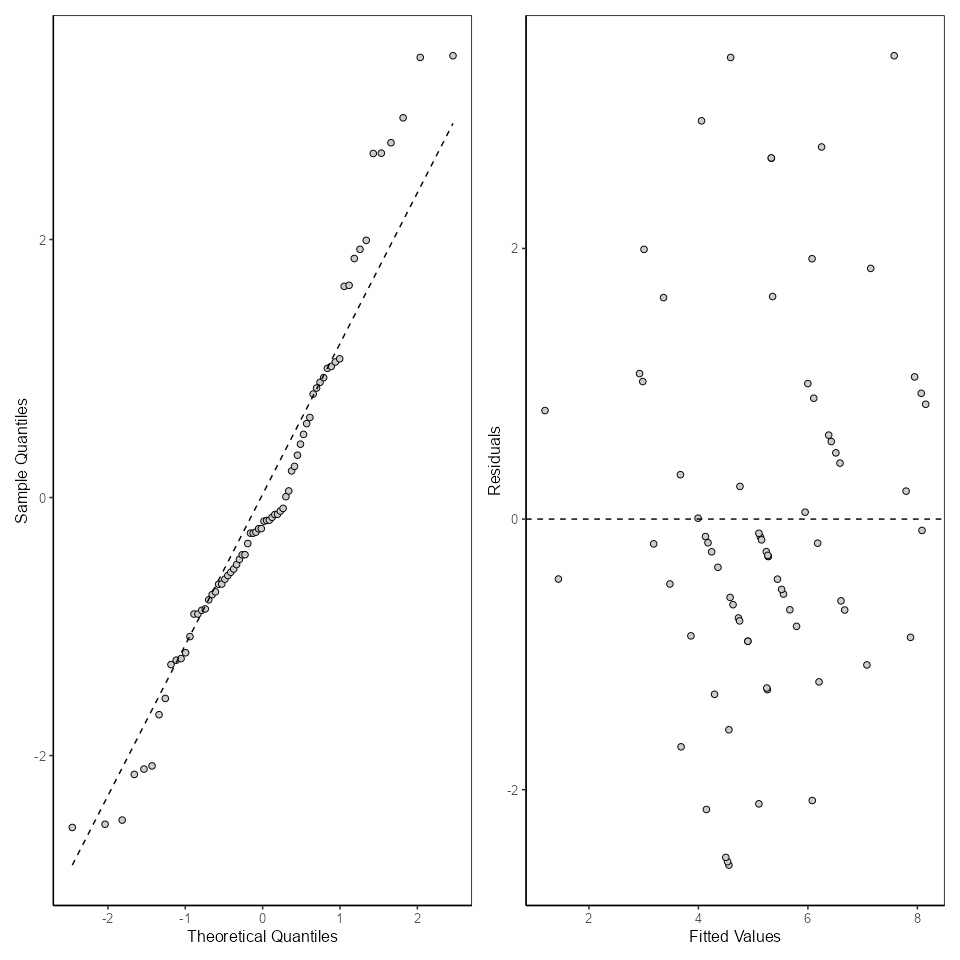
Violin Plot with boxplots



*Note*. This is the note below the figure.

Figure 3

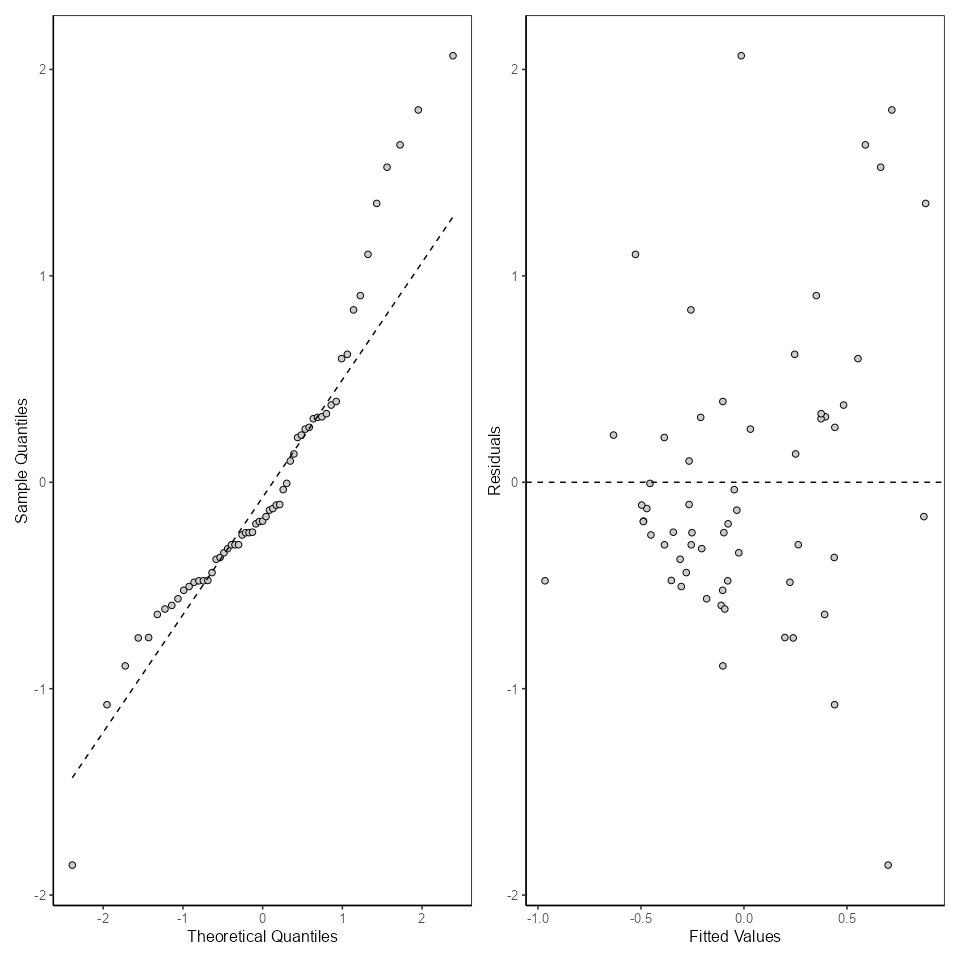
Histogram of Residuals



*Note*. This is the note below the figure.

Figure 4

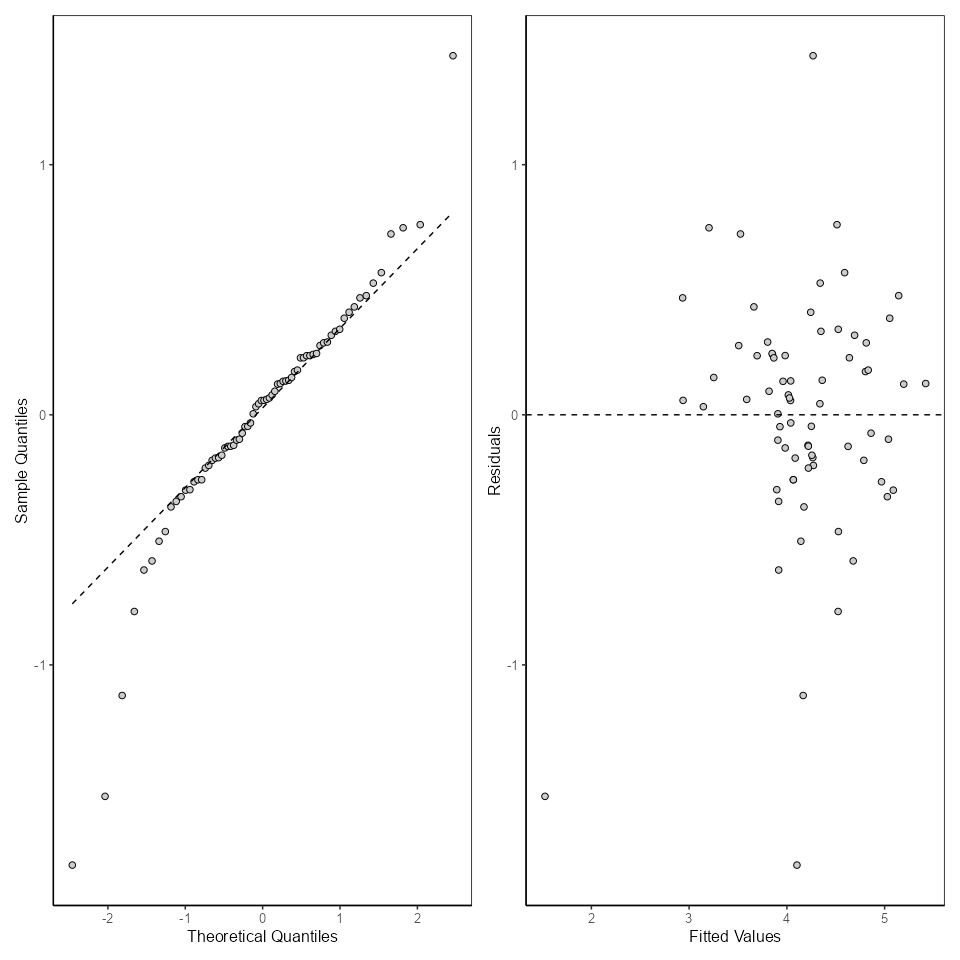
Histogram and QQ-Plot of Residuals for the running Distance Model



*Note*. This is the note below the figure.

Figure 5

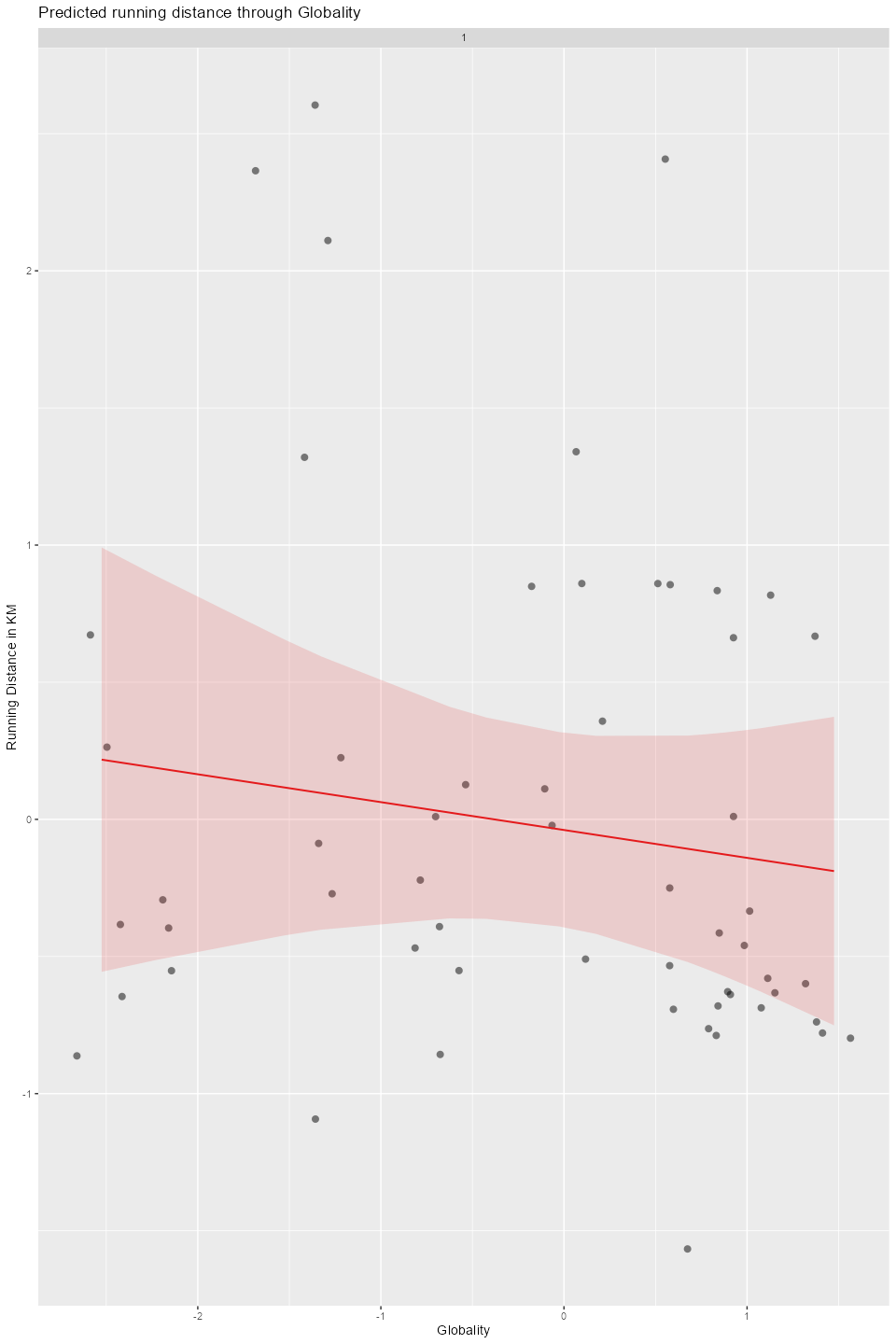
Histogram of Residuals



*Note*. This is the note below the figure.

Figure 6

Predictive Contribution of Globality, which interacts with pride



*Note*. This is the note below the figure.

# Appendix

# Title for Appendix