**Supplementary Materials**

**Extrinsic Convergent Validity to Prevent Jingle and Jangle Fallacies**

**1. Tables for Simulation**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Table S1.  *Type 1 error rates for the tests of dependent correlations when one of the scores is normally distributed and the other has skewness of 1.25 and kurtosis of 3.25.* | | | | | | | | | | | | | |
|  |  | Correlation Between the Two Measures | | | | | | | | | | | |
|  |  |  | 0.5 |  |  | 0.6 |  |  | 0.7 |  |  | 0.8 |  |
|  |  | Correlation of the Two Measures with the Outcome | | | | | | | | | | | |
| N | Test | 0.3 | 0.5 | 0.7 | 0.3 | 0.5 | 0.7 | 0.3 | 0.5 | 0.7 | 0.3 | 0.5 | 0.7 |
| 50 | Williams | 0.040 | 0.058 | 0.060 | 0.054 | 0.048 | **0.086** | 0.048 | 0.064 | **0.078** | 0.052 | 0.056 | 0.072 |
|  | Δ s.e. | **0.022** | **0.008** | **0.000** | **0.024** | **0.016** | **0.004** | 0.034 | **0.020** | **0.012** | 0.036 | **0.020** | **0.008** |
|  | Boot | 0.064 | 0.070 | 0.066 | 0.056 | 0.060 | **0.078** | 0.068 | **0.084** | 0.072 | **0.076** | **0.076** | **0.078** |
|  | χ2 test | 0.026 | **0.018** | **0.006** | 0.052 | **0.020** | **0.010** | 0.046 | 0.036 | **0.020** | 0.042 | 0.028 | **0.014** |
| 100 | Williams | 0.056 | 0.074 | 0.072 | 0.042 | 0.074 | **0.100** | 0.042 | 0.066 | 0.060 | 0.036 | 0.064 | **0.092** |
|  | Δ s.e. | 0.036 | 0.034 | **0.002** | **0.022** | **0.024** | **0.010** | 0.030 | **0.024** | **0.004** | 0.030 | **0.024** | **0.014** |
|  | Boot | 0.064 | 0.068 | 0.062 | 0.056 | **0.094** | **0.094** | 0.068 | 0.058 | 0.062 | 0.058 | 0.068 | **0.078** |
|  | χ2 test | 0.048 | 0.038 | **0.006** | 0.034 | 0.028 | **0.010** | 0.032 | 0.028 | **0.008** | 0.030 | 0.028 | **0.018** |
| 200 | Williams | 0.036 | 0.072 | **0.078** | **0.076** | 0.062 | 0.072 | 0.064 | **0.090** | **0.120** | 0.058 | **0.080** | **0.108** |
|  | Δ s.e. | 0.028 | 0.032 | **0.004** | 0.052 | 0.024 | **0.010** | 0.046 | 0.038 | **0.020** | 0.040 | 0.042 | **0.024** |
|  | Boot | 0.052 | **0.076** | 0.066 | **0.082** | 0.054 | 0.066 | 0.066 | **0.084** | **0.084** | 0.060 | 0.070 | **0.082** |
|  | χ2 test | 0.032 | 0.034 | **0.006** | 0.062 | 0.026 | **0.010** | 0.050 | 0.048 | **0.024** | 0.046 | 0.042 | 0.026 |
| 500 | Williams | 0.056 | 0.070 | **0.106** | 0.040 | 0.074 | **0.130** | 0.068 | **0.088** | **0.140** | 0.060 | **0.098** | **0.230** |
|  | Δ s.e. | 0.052 | 0.028 | **0.012** | 0.034 | 0.034 | **0.020** | 0.042 | 0.040 | **0.012** | 0.052 | 0.052 | 0.068 |
|  | Boot | 0.056 | 0.062 | **0.090** | 0.046 | 0.064 | **0.118** | 0.070 | **0.078** | **0.110** | 0.064 | **0.086** | **0.160** |
|  | χ2 test | 0.052 | 0.028 | **0.012** | 0.034 | 0.036 | **0.020** | 0.058 | 0.046 | **0.022** | 0.054 | 0.052 | 0.070 |
| 1000 | Williams | 0.058 | **0.100** | **0.164** | 0.048 | **0.100** | **0.192** | 0.054 | **0.094** | **0.166** | 0.064 | **0.112** | **0.270** |
|  | Δ s.e. | 0.044 | 0.050 | **0.022** | 0.038 | 0.048 | 0.032 | 0.032 | 0.048 | 0.036 | 0.054 | 0.058 | **0.090** |
|  | Boot | 0.056 | **0.090** | **0.120** | 0.056 | **0.082** | **0.162** | 0.056 | **0.078** | **0.126** | 0.064 | **0.100** | **0.224** |
|  | χ2 test | 0.044 | 0.052 | **0.022** | 0.040 | 0.048 | 0.032 | 0.036 | 0.048 | 0.036 | 0.054 | 0.058 | **0.090** |
| **Note**: Correlations of the measures with the outcome were the same, so the difference is zero. In bold red are the Type 1 error rates outside of Bradley’s (1978) robust criterion (.025, .075). N=sample size; Boot=bootstrap confidence intervals; Will=Williams’ test for dependent correlations; Δ s.e. = multivariate delta method standard error. | | | | | | | | | | | | | |

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| Table S2A. *Power to detect the difference of two dependent correlations across different tests when the normal score has a higher correlation with the outcome than the nonnormal score (skewness is 1.25 and kurtosis is 3.25)*. | | | | | | | | | | | | | | | | | | | |
|  |  |  |  | N=50 | | | | N=100 | | | | N=200 | | | | N=500 | | | |
| *r1* | *r2* | *q* | *i* | Will | Δ s.e. | Boot | χ2 | Will | Δ s.e. | Boot | χ2 | Will | Δ s.e. | Boot | χ2 | Will | Δ s.e. | Boot | χ2 |
| 0.3 | 0.5 | 0.24 | 0.5 | 0.352 | 0.230 | 0.396 | 0.274 | 0.582 | 0.486 | 0.644 | 0.518 | **0.902** | **0.828** | **0.896** | **0.856** | **0.996** | **0.994** | **0.994** | **0.994** |
| 0.3 | 0.5 | 0.24 | 0.6 | 0.408 | 0.312 | 0.462 | 0.348 | 0.680 | 0.552 | 0.688 | 0.598 | **0.896** | **0.858** | **0.894** | **0.870** | **1.000** | **1.000** | **1.000** | **1.000** |
| 0.3 | 0.5 | 0.24 | 0.7 | 0.488 | 0.398 | 0.540 | 0.440 | **0.814** | 0.728 | **0.816** | 0.766 | **0.964** | **0.944** | **0.968** | **0.950** | **1.000** | **1.000** | **1.000** | **1.000** |
| 0.3 | 0.5 | 0.24 | 0.8 | 0.698 | 0.554 | 0.714 | 0.628 | **0.916** | **0.866** | **0.936** | **0.880** | **1.000** | **0.994** | **0.994** | **0.994** | **1.000** | **1.000** | **1.000** | **1.000** |
| 0.5 | 0.7 | 0.32 | 0.5 | 0.482 | 0.222 | 0.510 | 0.270 | **0.810** | 0.510 | **0.812** | 0.560 | **0.980** | **0.902** | **0.978** | **0.908** | **1.000** | **1.000** | **1.000** | **1.000** |
| 0.5 | 0.7 | 0.32 | 0.6 | 0.556 | 0.266 | 0.578 | 0.334 | **0.828** | 0.632 | **0.830** | 0.676 | **0.992** | **0.954** | **0.990** | **0.958** | **1.000** | **1.000** | **1.000** | **1.000** |
| 0.5 | 0.7 | 0.32 | 0.7 | 0.680 | 0.436 | 0.698 | 0.492 | **0.908** | 0.766 | **0.906** | 0.798 | **1.000** | **0.990** | **0.996** | **0.990** | **1.000** | **1.000** | **1.000** | **1.000** |
| 0.5 | 0.7 | 0.32 | 0.8 | **0.812** | 0.594 | **0.840** | 0.668 | **0.976** | **0.910** | **0.970** | **0.924** | **1.000** | **1.000** | **1.000** | **1.000** | **1.000** | **1.000** | **1.000** | **1.000** |
| 0.3 | 0.7 | 0.56 | 0.5 | **0.942** | **0.854** | **0.932** | **0.888** | **1.000** | **0.988** | **0.998** | **0.994** | **1.000** | **1.000** | **1.000** | **1.000** | **1.000** | **1.000** | **1.000** | **1.000** |
| 0.3 | 0.7 | 0.56 | 0.6 | **0.982** | **0.918** | **0.976** | **0.942** | **1.000** | **1.000** | **1.000** | **1.000** | **1.000** | **1.000** | **1.000** | **1.000** | **1.000** | **1.000** | **1.000** | **1.000** |
| 0.3 | 0.7 | 0.56 | 0.7 | **0.996** | **0.974** | **1.000** | **0.980** | **1.000** | **1.000** | **1.000** | **1.000** | **1.000** | **1.000** | **1.000** | **1.000** | **1.000** | **1.000** | **1.000** | **1.000** |
| 0.3 | 0.7 | 0.56 | 0.8 | **1.000** | **0.998** | **1.000** | **1.000** | **1.000** | **1.000** | **1.000** | **1.000** | **1.000** | **1.000** | **1.000** | **1.000** | **1.000** | **1.000** | **1.000** | **1.000** |
| **Note**: Bold green is for conditions with power above .80. i=correlation between measure 1 and measure 2; r1= correlation of measure 1 with outcome; r2=correlation of measure 2 with outcome; N=sample size; Boot=bootstrap confidence intervals; Will=Williams’ test; Δ s.e. = multivariate delta method standard error; χ2 =chi-square test; q=Cohen’s q. | | | | | | | | | | | | | | | | | | | |

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| Table S2B. *Power to detect the difference of two dependent correlations across different tests when the nonnormal score (skewness is 1.25 and kurtosis is 3.25)* *has a higher correlation with the outcome than the normal score*. | | | | | | | | | | | | | | | | | | | |
|  |  |  |  | N=50 | | | | N=100 | | | | N=200 | | | | N=500 | | | |
| *r1* | *r2* | *q* | *i* | Will | Δ s.e. | Boot | χ2 | Will | Δ s.e. | Boot | χ2 | Will | Δ s.e. | Boot | χ2 | Will | Δ s.e. | Boot | χ2 |
| 0.5 | 0.3 | 0.24 | 0.5 | 0.320 | 0.204 | 0.356 | 0.252 | 0.534 | 0.402 | 0.562 | 0.446 | **0.810** | 0.732 | **0.824** | 0.768 | **0.998** | **0.994** | **0.994** | **0.994** |
| 0.5 | 0.3 | 0.24 | 0.6 | 0.396 | 0.292 | 0.428 | 0.342 | 0.622 | 0.496 | 0.618 | 0.544 | **0.880** | **0.806** | **0.886** | **0.830** | **1.000** | **0.998** | **0.996** | **0.998** |
| 0.5 | 0.3 | 0.24 | 0.7 | 0.452 | 0.336 | 0.494 | 0.394 | 0.730 | 0.618 | 0.754 | 0.662 | **0.946** | **0.904** | **0.940** | **0.914** | **1.000** | **1.000** | **1.000** | **1.000** |
| 0.5 | 0.3 | 0.24 | 0.8 | 0.582 | 0.458 | 0.612 | 0.524 | **0.862** | **0.806** | **0.860** | **0.820** | **0.994** | **0.982** | **0.980** | **0.988** | **1.000** | **1.000** | **1.000** | **1.000** |
| 0.7 | 0.5 | 0.32 | 0.5 | 0.396 | 0.166 | 0.396 | 0.204 | 0.674 | 0.374 | 0.682 | 0.422 | **0.944** | 0.798 | **0.934** | **0.808** | **1.000** | **0.986** | **0.992** | **0.986** |
| 0.7 | 0.5 | 0.32 | 0.6 | 0.454 | 0.210 | 0.486 | 0.254 | 0.724 | 0.464 | 0.728 | 0.506 | **0.948** | **0.844** | **0.944** | **0.862** | **1.000** | **0.998** | **1.000** | **0.998** |
| 0.7 | 0.5 | 0.32 | 0.7 | 0.560 | 0.318 | 0.584 | 0.376 | **0.834** | 0.618 | **0.844** | 0.670 | **0.984** | **0.928** | **0.968** | **0.936** | **1.000** | **1.000** | **1.000** | **1.000** |
| 0.7 | 0.5 | 0.32 | 0.8 | 0.718 | 0.478 | 0.716 | 0.546 | **0.914** | 0.772 | **0.910** | **0.800** | **1.000** | **0.992** | **0.994** | **0.994** | **1.000** | **1.000** | **1.000** | **1.000** |
| 0.7 | 0.3 | 0.56 | 0.5 | **0.916** | 0.762 | **0.926** | **0.826** | **1.000** | **0.992** | **1.000** | **0.992** | **1.000** | **1.000** | **1.000** | **1.000** | **1.000** | **1.000** | **1.000** | **1.000** |
| 0.7 | 0.3 | 0.56 | 0.6 | **0.950** | **0.870** | **0.958** | **0.904** | **1.000** | **0.994** | **1.000** | **0.996** | **1.000** | **1.000** | **1.000** | **1.000** | **1.000** | **1.000** | **1.000** | **1.000** |
| 0.7 | 0.3 | 0.56 | 0.7 | **0.988** | **0.938** | **0.984** | **0.952** | **1.000** | **1.000** | **1.000** | **1.000** | **1.000** | **1.000** | **1.000** | **1.000** | **1.000** | **1.000** | **1.000** | **1.000** |
| 0.7 | 0.3 | 0.56 | 0.8 | **0.996** | **0.996** | **0.998** | **0.996** | **1.000** | **1.000** | **1.000** | **1.000** | **1.000** | **1.000** | **1.000** | **1.000** | **1.000** | **1.000** | **1.000** | **1.000** |
| **Note**: Bold green is for conditions with power above .80. i=correlation between measure 1 and measure 2; r1= correlation of measure 1 with outcome; r2=correlation of measure 2 with outcome; N=sample size; Boot=bootstrap confidence intervals; Will=Williams’ test; Δ s.e. = multivariate delta method standard error; χ2 =chi-square test; q=Cohen’s q. | | | | | | | | | | | | | | | | | | | |

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| Table S3. *Type 1 error rates for the tests of dependent correlations when one of the scores is normally distributed and the other has skewness of 2.25 and kurtosis of 7.* | | | | | | | | | | |
|  |  | Correlation Between the Two Measures | | | | | | | | |
|  |  |  | 0.5 |  |  | 0.6 |  |  | 0.7 |  |
|  |  | Correlation of the Two Measures with the Outcome | | | | | | | | |
| N | Test | 0.3 | 0.5 | 0.7 | 0.3 | 0.5 | 0.7 | 0.3 | 0.5 | 0.7 |
| 50 | Williams | 0.070 | **0.164** | **0.372** | **0.088** | **0.184** | **0.406** | **0.096** | **0.198** | **0.404** |
|  | Δ s.e. | 0.048 | **0.108** | **0.148** | 0.064 | **0.110** | **0.198** | **0.078** | **0.112** | **0.206** |
|  | Boot | **0.080** | **0.148** | **0.286** | **0.098** | **0.176** | **0.340** | **0.106** | **0.188** | **0.324** |
|  | χ2 test | 0.066 | **0.130** | **0.170** | **0.082** | **0.142** | **0.240** | **0.088** | **0.150** | **0.244** |
| 100 | Williams | **0.082** | **0.278** | **0.560** | **0.128** | **0.284** | **0.584** | **0.130** | **0.308** | **0.616** |
|  | Δ s.e. | 0.058 | **0.194** | **0.274** | **0.094** | **0.186** | **0.358** | **0.102** | **0.208** | **0.388** |
|  | Boot | **0.080** | **0.266** | **0.486** | **0.122** | **0.242** | **0.474** | **0.142** | **0.260** | **0.508** |
|  | χ2 test | 0.074 | **0.210** | **0.304** | **0.110** | **0.196** | **0.392** | **0.118** | **0.236** | **0.414** |
| 200 | Williams | **0.160** | **0.460** | **0.790** | **0.200** | **0.438** | **0.844** | **0.198** | **0.504** | **0.868** |
|  | Δ s.e. | **0.136** | **0.340** | **0.568** | **0.178** | **0.360** | **0.632** | **0.168** | **0.400** | **0.704** |
|  | Boot | **0.174** | **0.388** | **0.700** | **0.202** | **0.370** | **0.740** | **0.220** | **0.432** | **0.800** |
|  | χ2 test | **0.148** | **0.366** | **0.610** | **0.188** | **0.366** | **0.640** | **0.176** | **0.416** | **0.716** |
| 500 | Williams | **0.346** | **0.808** | **0.990** | **0.370** | **0.824** | **0.996** | **0.436** | **0.836** | **0.994** |
|  | Δ s.e. | **0.308** | **0.706** | **0.942** | **0.326** | **0.734** | **0.962** | **0.390** | **0.788** | **0.978** |
|  | Boot | **0.336** | **0.744** | **0.970** | **0.338** | **0.758** | **0.974** | **0.414** | **0.792** | **0.994** |
|  | χ2 test | **0.322** | **0.724** | **0.950** | **0.334** | **0.740** | **0.964** | **0.390** | **0.798** | **0.980** |
| 1000 | Williams | **0.562** | **0.972** | **1.000** | **0.610** | **0.974** | **1.000** | **0.694** | **0.986** | **1.000** |
|  | Δ s.e. | **0.526** | **0.952** | **0.996** | **0.576** | **0.958** | **1.000** | **0.678** | **0.974** | **1.000** |
|  | Boot | **0.538** | **0.956** | **0.994** | **0.588** | **0.958** | **0.998** | **0.676** | **0.978** | **1.000** |
|  | χ2 test | **0.542** | **0.958** | **0.996** | **0.584** | **0.962** | **1.000** | **0.682** | **0.974** | **1.000** |