

# UniODA vs. Chi-Square: Comparing Measures of Effect Size

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A maximum-corrected measure of effect size for chi-square ( $E_{\chi^2}$ ) is compared with an alternative measure that is maximum- and chance-corrected ( $ESS$ ), for an application assessing the relationship between voting on the Refugee Act of 1990 and political affiliation in the U.S. House of Representatives.

Yarnold<sup>1</sup> presented data in Table 1 on the voting behavior regarding the Refugee Act of 1980 of  $N = 152$  Republican and  $N = 78$  Democratic members of the U.S. House of Representatives. Here, chi-square = 84.3 (df = 1,  $N = 407$ ),  $p \ll 0.05$ : a highly statistically significant effect.

Table 1: Political Affiliation and Refugee Vote

	Political Affiliation	
Vote	Republican	Democrat
Con	118	78
Pro	34	177

Johnston, et al.<sup>2</sup> developed a maximum-corrected measure of effect size for chi-square on which 0 = isomorphic observed and expected proportions, and 1 = maximum possible departure between observed and expected proportions for the application. Here,  $E_{\chi^2} = 0.046$ , indicating that the effect was weak—reflecting less than 5% of the maximum possible departure between observed and expected proportions.<sup>2</sup>

In the ODA paradigm the effect size estimate for this design,  $ESS$ , is both chance- and maximum-corrected:  $ESS = 0$  under chance

conditions;  $ESS = 1$  when all data fall into the (hypothesized) diagonal of the table (Table 1).<sup>3-9</sup> The non-directional UniODA model assessing  $p$  and  $ESS$  here was obtained using the following UniODA<sup>3</sup> and MegaODA<sup>10-12</sup> software syntax:

```
OPEN DATA;  
OUTPUT refugee.out;  
CATEGORICAL ON;  
TABLE 2;  
MCARLO ITER 25000;  
DATA;  
118 78  
34 177  
END DATA;  
GO;
```

Here  $p \ll 0.05$ , indicating that the effect is highly statistically significant. Furthermore,  $ESS = 47.04$  reflects a moderate effect size, representing 47.04% of the theoretical possible improvement (i.e., the proportion of the sample falling in the diagonal) beyond what is attributable to chance.<sup>3,4</sup>

## References

- <sup>1</sup>Yarnold BM (1990). *Refugees without refuge: Formation and failed implementation of U.S. political asylum policy in the 1980's*. Lanham, MD: University Press.
- <sup>2</sup>Johnston JE, Berry KJ, Mielke PW (2006). Measures of effect size for chi-squared and likelihood-ratio goodness-of-fit tests. *Perceptual and Motor Skills*, 103, 412-414. DOI: 10.2466/PMS.103.6.412-414
- <sup>3</sup>Yarnold PR, Soltysik RC (2005). *Optimal data analysis: A guidebook with software for Windows*. Washington, DC: APA Books.
- <sup>4</sup>Yarnold PR, Soltysik RC (In Review). *Maximizing predictive accuracy*. Chicago, IL: ODA Books.
- <sup>5</sup>Yarnold PR, Soltysik RC (2010). UniODA vs. chi-square: Ordinal data sometimes feign categorical. *Optimal Data Analysis*, 1, 62-66. URL: <http://optimalprediction.com/files/pdf/V1A12.pdf>
- <sup>6</sup>Yarnold PR (2014). UniODA vs. chi-square: Audience effect on smile production in infants. *Optimal Data Analysis*, 3, 3-5. URL: <http://optimalprediction.com/files/pdf/V3A1.pdf>
- <sup>7</sup>Yarnold PR (2014). UniODA vs. chi-square: Discriminating inhibited and uninhibited infant profiles. *Optimal Data Analysis*, 3, 9-11. URL: <http://optimalprediction.com/files/pdf/V3A3.pdf>
- <sup>8</sup>Yarnold PR (2015). Is going first an advantage in cribbage? *Optimal Data Analysis*, 5, 129-130. URL: <http://optimalprediction.com/files/pdf/V4A25.pdf>
- <sup>9</sup>Yarnold PR (2015). UniODA vs. Cochran's Q test for related proportions: Measures of effect size. *Optimal Data Analysis*, 4, 135-136. URL: <http://optimalprediction.com/files/pdf/V4A26.pdf>
- <sup>10</sup>Soltysik RC, Yarnold PR (2013). MegaODA large sample and BIG DATA time trials: Separating the chaff. *Optimal Data Analysis*, 2, 194-197. URL: <http://optimalprediction.com/files/pdf/V2A29.pdf>
- <sup>11</sup>Soltysik RC, Yarnold PR (2013). MegaODA large sample and BIG DATA time trials: Harvesting the Wheat. *Optimal Data Analysis*, 2, 202-205. URL: <http://optimalprediction.com/files/pdf/V2A31.pdf>
- <sup>12</sup>Yarnold PR, Soltysik RC (2013). MegaODA large sample and BIG DATA time trials: Maximum velocity analysis. *Optimal Data Analysis*, 2, 220-221. URL: <http://optimalprediction.com/files/pdf/V2A35.pdf>

## Author Notes

The study analyzed de-individuated data and was exempt from Institutional Review Board review. No conflict of interest was reported.

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