

WISE Confidence Interval Overlap Game

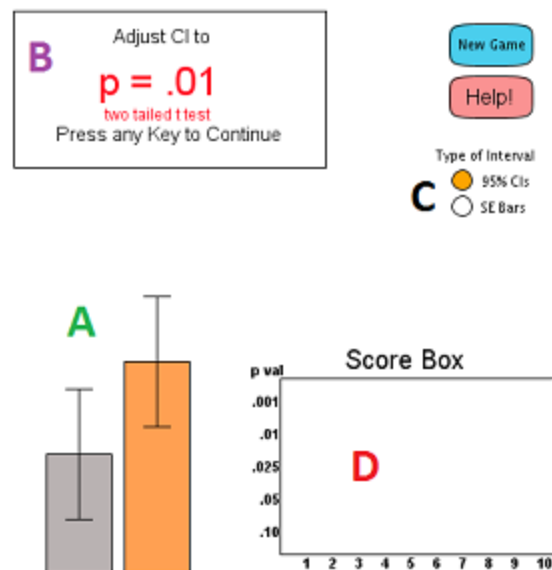
Purpose of the Confidence Interval Applet

Although confidence intervals (CIs) supplement the interpretation of point estimates, research shows that both professionals and students often misinterpret them. Specifically, many professionals believe that any overlap of 95% CI denotes a non-significant difference between means. This misinterpretation is called the “overlap fallacy” because two 95% CIs can overlap to a great extent and still reflect a statistically significant difference between means.

The [WISE CI Overlap Applet](#) and [associated guide](#) were designed to aid learners in gaining a conceptual understanding of the relationship between CI overlap and levels of statistical significance. We recommend that applet and guide be reviewed before taking on the game.

Features of the Confidence Interval Applet

The user is presented with a bar chart representing two means, along with corresponding CIs (Region **A**). The orange bar can be dynamically manipulated up/down to produce varying levels of CI overlap. The user’s task is to set the amount of overlap between two 95% CIs (or standard error bars) to correspond to a given p -value (Region **B**). All p -values result from a two-tailed independent samples t -test ($n = 200$). The user can select 95% CIs or SE bars for the display by clicking the appropriate radio button (Region **C**). After each trial a score is given reflecting the accuracy of the estimate (Region **D**). At the end of five trials, a final score is presented followed by a motivational picture or video. A perfect score is rewarded with a special picture. To load the CI overlap game, click [here](#).



Confidence Interval Overlap References

Articles 1 - 3 demonstrate the confidence interval overlap fallacy. Article 1 outlines the problem, article 2 demonstrates how ubiquitous the problem is in academia, and article 3 describes some of the issues related to interpreting CI overlap with respect to statistical significance.

- 1) Austin, P.C., & Hux, J.E. (2002). A brief note on overlapping confidence intervals. *Journal of Vascular Surgery*, 36, 194-195. Retrieved from http://www.jvascsurg.org/issues?issue_key=S0741-5214%2805%29X7126-9
- 2) Belia, S., Fidler, F., Williams, J., & Cumming, G. (2005). Researchers misunderstand confidence intervals and standard error bars. *Psychological Methods*, 10, 389-396. doi:10.1037/1082-989X.10.4.389. Retrieved from <http://irt.com.ne.kr/data/researchers%20misunderstand%20ci%20and%20error%20bars.pdf>
- 3) Schenker, N., & Gentleman, J.F. (2001) On judging the significance of differences by examining the overlap between confidence intervals. *The American Statistician*, 55, 182-186. doi: 10.1198/000313001317097960. Retrieved from <http://www.mendeley.com/research/on-judging-the-significance-of-differences-by-examining-the-overlap-between-confidence-intervals/>

References 4 -9 are teaching papers and interactive applets for those interested in lecturing on CIs. References 4-6 are interactive applets for teaching different aspects of CIs. Each applet is accompanied by a guide that serves as a teaching paper.

- 4) Mary, J.C., Berger, D.E., Pentoney, C.S., and WISE team (2012). WISE confidence interval overlap applet and guide. http://wise.cgu.edu/ci_overlap/ci_overlap_applet/.
- 5) Pentoney, C.S., Berger, D.E., Mary, J.C., and WISE team (2012). WISE bootstrapping applet and guide. <http://www.wise.cgu.edu/bootstrapping>.
- 6) Pentoney, C.S., Berger, D.E., Mary, J.C., and WISE team (2012). WISE confidence interval creation applet and guide. http://wise.cgu.edu/ci_creation/ci_creation_applet/index.html.
- 7) Bertie, A., & Farrington, P. (2003). Teaching confidence intervals with java applets. *Teaching Statistics*, 25, 70-75. doi: 10.1111/1467-9639.00134. Retrieved from <http://www.jsc.nildram.co.uk/articles/CIapplets.pdf>
- 8) Cumming, G. (2007). Inference by eye: Pictures of confidence intervals and thinking about levels of confidence. *Teaching Statistics*, 29, 89-93. doi: 10.1111/j.1467-9639.2007.00267.x. Retrieved from http://psychweb.psy.umt.edu/denis/datadecision/front/stat_II_2011/error_bars.pdf
- 9) Hagtvedt, R., Jones, T.G., & Jones, K. (2008). Teaching confidence intervals using simulation. *Teaching Statistics*, 30, 53-56. doi: 10.1111/j.1467-9639.2008.00308.x