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Is the Curve Relating Temperature to Aggression Linear or Curvilinear? A Response to Bell (2005) and to Cohn and Rotton (2005)

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P. Bell (2005) recommended examining the relationship between temperature and assaults during the hottest times of day and during the hottest months of the year. The authors' analyses of these data show a linear rather than inverted U-shaped relationship between temperature and assault during the hottest times of day and in the hottest months of the year. E. Cohn and J. Rotton (2005) recommended analyzing the 6 hr with the highest assaults versus the 6 hr with the lowest assaults. During high assault periods, there is a strong positive linear relationship between temperature and assault. During low assault periods, there is no relationship between temperature and assaults. Assaults and other violent crimes might decrease when temperatures are very hot, but the Minneapolis data set does not allow for testing of this hypothesis because Minneapolis is too cold.

Keywords: aggression, assault, heat, hot, temperature

In this article, we address the concerns raised by Bell (2005) and by Cohn and Rotton (2005) about our reanalysis of Cohn and Rotton's Minneapolis data set. The data set contains ambient temperatures and assault rates received by the Minneapolis Police Department in 1987 and 1988. Cohn and Rotton plotted assault against temperature and found an inverted U-shaped curve, with assaults peaking at about 75 °F (23.89 °C). We believe this curve is misleading because it fails to take into account time of day. Both time of day and assaults are strongly correlated with temperature, but in opposite directions. Assaults are highest in the late evening and early morning hours when temperatures are coolest, whereas temperatures are highest in the afternoon hours. Furthermore, a large portion of the time of day effect on assaults is likely due to the differential types of activities and environments in which people typically engage at different times of the day.

Bell (2005) recommends examining the relationship between temperature and assaults only during the time of day when temperatures are hottest. If there is a downturn in assaults, it should occur when temperatures are hottest. In this data set, temperatures are hottest between 12:00 and 2:59 p.m. (see Figure 2 in Bushman, Wang, & Anderson, 2005). Figure 1 shows the relationship between temperature and assault during the hottest time period. As can be seen in Figure 1, the relationship between temperature and assault is linear. There is no sharp downturn when temperatures are hot. In addition, if one examines the quadratic temperature regression coefficients for the 7 days of the week during the hottest time period (i.e., 12:00 p.m. to 2:59 p.m.), only three of the seven regression coefficients are negative, and none of the three negative regression coefficients is statistically significant (see Table 5 in Cohn & Rotton, 1997).

Bell (2005) also suggests that the downturn in aggression during the hottest time of the day should be most pronounced during the hottest months of the year. As can be seen in Figure 2, the three hottest months of the year in Minneapolis are June, July, and August. Figure 3 shows that the relationship between temperature and assault is linear during the hottest time period (i.e., 12:00 to 2:59 p.m.) in the three hottest months (i.e., June, July, August). The curve does not have an inverted U shape.

Although Bell's (2005) hypotheses make good theoretical sense, the data do not support them. The relationship between temperature and assault is not curvilinear during the hottest time of the day, even if one examines only the hottest months of the year. In a hotter city, like Dallas, Texas, Bell's hypotheses might be supported by the data.

Cohn and Rotton's (2005) reply repeats the claim from their earlier article (Cohn & Rotton, 1997, Footnote 2) that removing month from the statistical model had little impact on the results and that the overall relation shows an important downturn at the highest temperatures. However, various reanalyses clearly contradict this claim (e.g., Anderson, Anderson, Dorr, DeNeve, & Flanagan, 2000).

Cohn and Rotton (2005) are correct in pointing out that the number of hours in the high and low assault periods is not the same in Figure 3 of Bushman et al. (2005). The high assault time period contains 6 hr (9:00 p.m. to 2:59 a.m. the next day),

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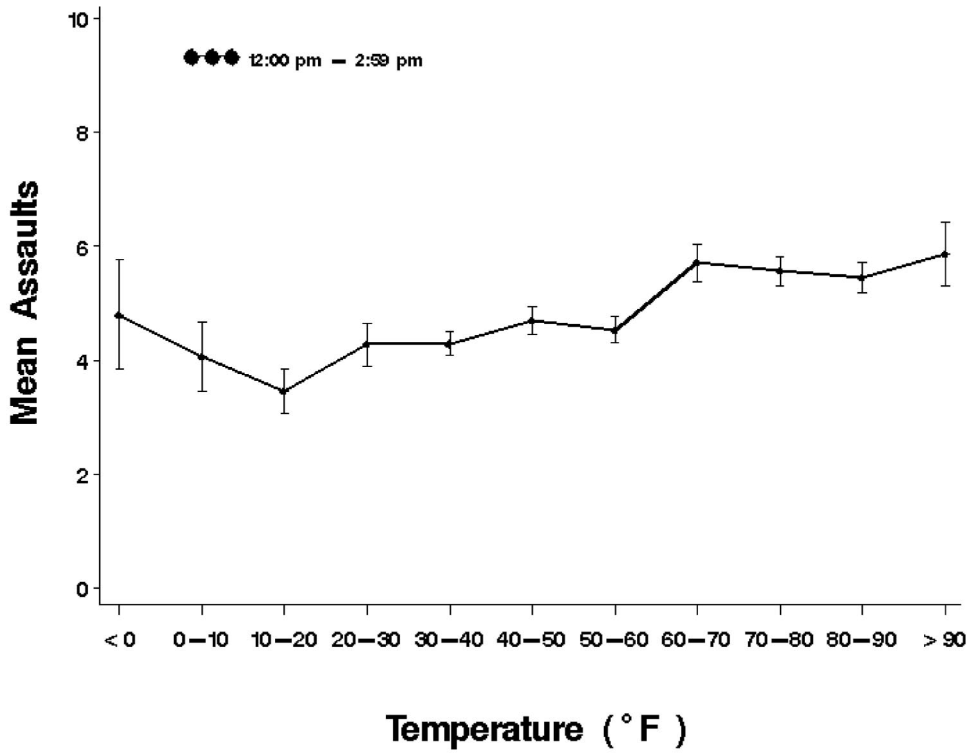

Figure 1. Relationship between temperature and mean assault during the hottest time period of the day (i.e., 12:00 p.m. to 2:59 p.m.). Errors bars represent plus or minus one standard error.

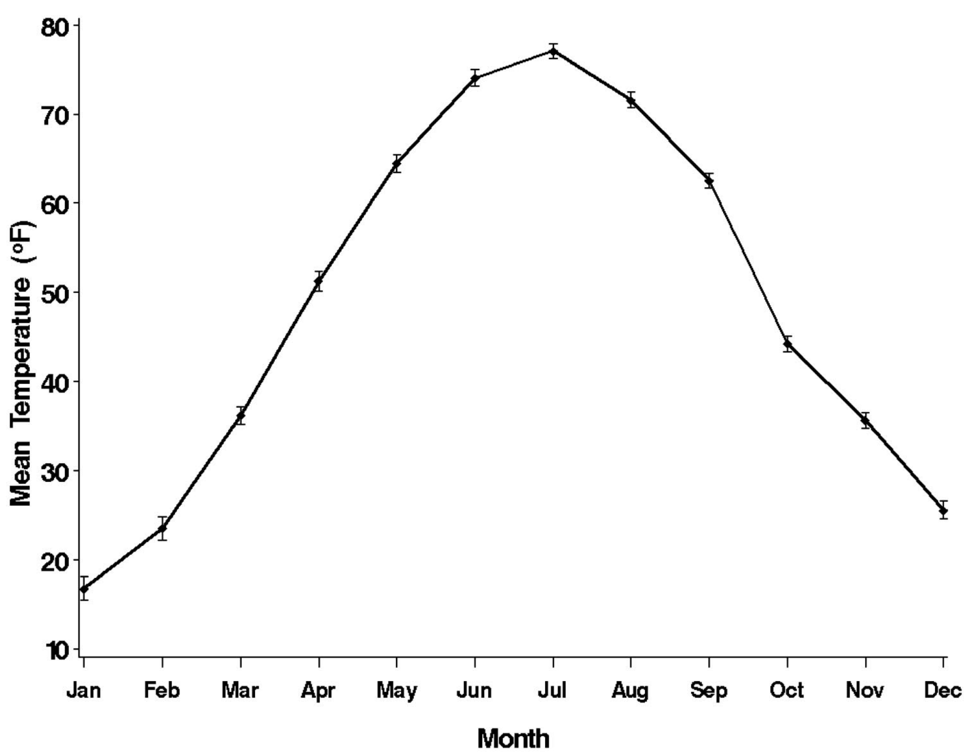

Figure 2. Relationship between month and temperature. The three hottest months are June, July, and August. Errors bars represent plus or minus one standard error.

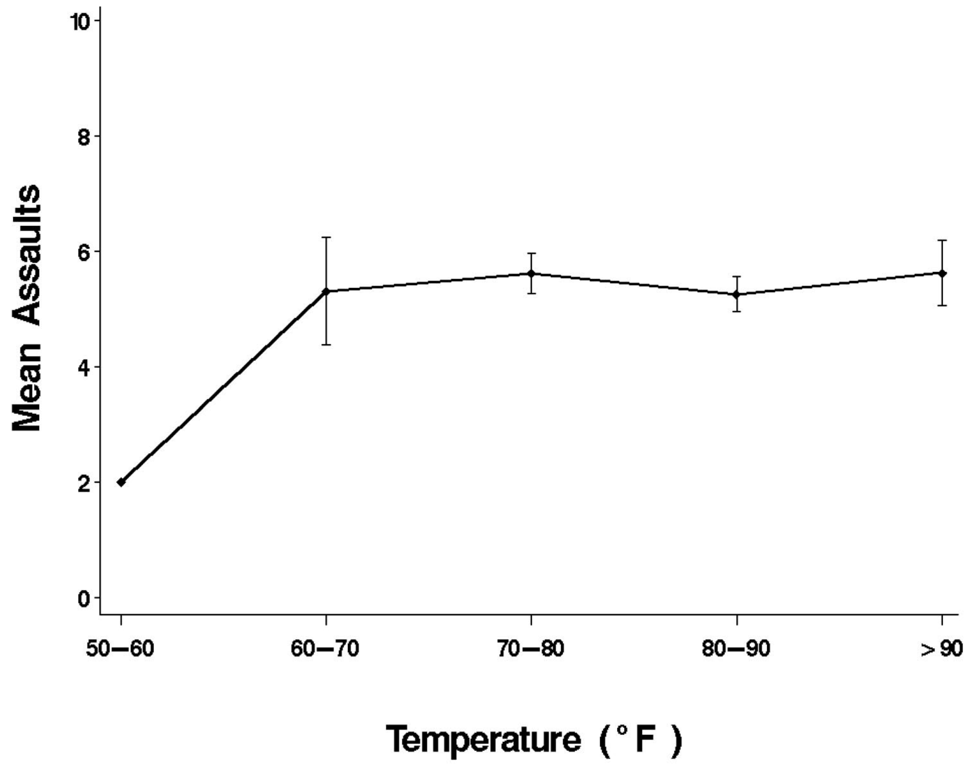

Figure 3. Relationship between temperature and mean assault during the hottest time period of the day (i.e., 12:00 p.m. to 2:59 p.m.) in the hottest months of the year (i.e., June, July, and August). Errors bars represent plus or minus one standard error.

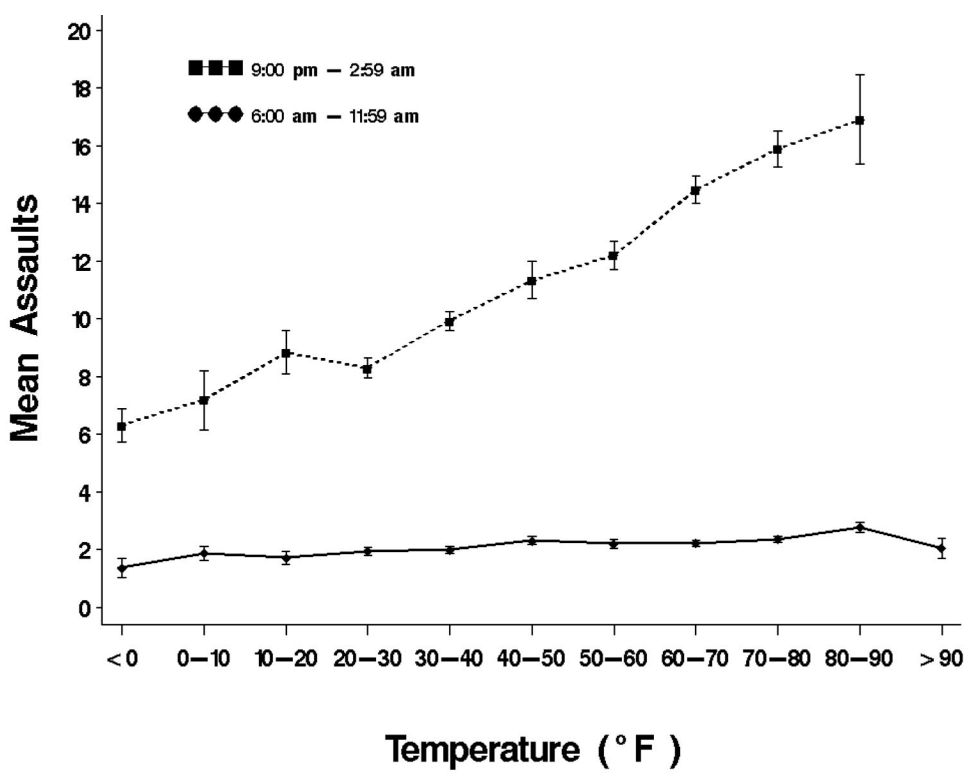

Figure 4. Relationship between temperature and mean assault during high assault periods (9:00 p.m. to 2:59 a.m.) and low assault periods (6:00 a.m. to 11:59 a.m.). Errors bars represent plus or minus one standard error.

whereas the low assault time period contains the remaining 18 hr (3:00 a.m. to 8:59 p.m.). However, the results are the same if one compares the 6 hr with the highest assaults with the 6 hr with the lowest assaults. The 6 hr with the highest assaults are 9:00 p.m. to 2:59 a.m. the next day, whereas the 6 hr with the lowest assaults are 6:00 a.m. to 11:59 a.m. (see Figure 2 of Bushman et al., 2005). Figure 4 shows the relationship between temperature and assault for high and low assault periods. As can be seen in Figure 4, there is a positive linear relationship between temperature and assault during the 6 hr when assaults are highest, and there is no relationship between temperature and assault during the 6 hr when assaults are lowest.

Cohn and Rotton (2005) claim that we are trying to "straighten out" the curve between temperature and violent behavior. On the contrary, in the past Anderson and colleagues have suggested that there are theoretical reasons for predicting a downturn in violence when temperatures are very hot (see Anderson, 1989; Anderson et al., 2000). However, we do not believe that this downturn occurs at 75 °F (23.89 °C), as suggested by Cohn and Rotton (1997). We also do not believe that Minneapolis is a good city to test the hypothesized downturn in aggression during hot temperatures because there are not enough truly hot days in Minneapolis.

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