

TOWARD A THERMOREGULATORY MODEL OF VIOLENCE

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ABSTRACT

The effects of climate on violent crime have long been noted in the criminological literature, but the data have been at best equivocal. To determine the direct effects of environmental temperature on emotion, physiological arousal and aggression, a series of studies was conducted. Subjects instigated to aggress against an insulting evaluator displayed an affective pattern of heightened aggression under conditions of uncomfortable heat, and an instrumental pattern under conditions of uncomfortable cold. These findings suggest intraindividual mechanisms and conditions that could account for the correlational findings mentioned: heightened temperature may lower an individual's threshold for aggression under conditions of interpersonal provocation. In addition, tympanic temperature monitoring changes at the anterior hypothalamus may be a useful index of instigation to aggression.

The study of climate generally, and temperature specifically, as a causal factor in violent crime has paralleled the development of criminology as a discipline. Quetelet's thermic theory of delinquency echoed Shakespeare's sentiment that "for now, these hot days, is the made blood stirring." In fact, Kropotkin's theory stated that "through a very simple mathematical operation we can find a formula that enables us to foretell the number of crimes merely by consulting the thermometer and the hygrometer." [1] In a related vein, Lombroso [2],

Guerry, Ferri and Ashaffenburg obtained evidence that violent crime fell along a south-north gradient in Italy, France and Germany that was accentuated during the hottest months [3]. In their view, heat directly affected physical mechanisms heightening emotions, and according to Lombroso, "stimulating quarrels, brawls, and stabbing affrays." Among more recent North American studies, Dexter's examination of 40,000 cases of assault [4], 184 murders and 3,891 cases of disciplinary action in the late 1890's led him to the conclusion that "temperature more than any other condition affects the emotional states which are conducive to fighting." This was a view echoed by Morrison [5]. Cohen, in his 1941 study, found the same trend for aggravated assault though not for homicides [6]. Bearley similarly found no annual fluctuation for homicide in South Carolina [7]. More recently, Goranson and King found that fifteen of seventeen American cities experiencing riots in 1967 had abnormally hot temperatures during those periods of violence [8]. Alford and Lewis appeared to find a seasonal fluctuation for rape in the U.S. but upon closer perusal the correlation broke down -- a peak in fact occurred in early fall when the temperature dropped [9].

It has been amply demonstrated that personal attack, frustration and viewing of violent incidents in the socially facilitating circumstances of the group can trigger violence [10]. The question is not whether social factors are involved. Observations of urban riots have indicated that they were triggered by incidents -- the arrest of the youth, the shooting of a fugitive -- that had they not been observed by groups of people gathered in the street or sitting on their front stoops, would have been regarded as commonplace and had few widespread social repercussions. If, however, it could be demonstrated that extreme ambient temperatures can in themselves trigger violent reactions resulting in heightened aggressive behavior at the interpersonal level, an explanatory basis for these repeatedly obtained observations and gross correlations between climate and violence could be established. Lack of such findings would suggest that social factors were paramount in the occurrence of such phenomena and that extreme heat, for example, merely created optimal social circumstances for those factors described to have their effect. Clearly experimental procedures would be more appropriate than correlational studies for such purposes. Thus, to test the effects of temperature, social instigation and physiological mediating events as factors in interpersonal aggression under carefully controlled laboratory conditions, a series of experiments was conducted.

EXPERIMENT 1

In the experimental procedure, thirty-four undergraduate males who had not been exposed to psychology or criminology courses were recruited to participate in an education experiment wherein they exchanged evaluations of each other's performance on a series of floor plan layout tasks [11]. After they were introduced, they were seated in separate 21.1 m. x 2.1 m. x 2.4 m. research

cubicles. The subject's cubicle was equipped with heating and cooling units preset at one of three experimental temperatures (30°C, 20°C, 10°C) from standards set by the American Society of Heating, Refrigeration and Air Conditioning Engineers, monitored by the experimenter. The subject was informed that after each task was completed the other subject (the experimenter's accomplice) would evaluate his work with written feedback, and that the subject was in turn to evaluate this assessment of his work with "sensory" feedback; that is, to administer shock by pressing a button connected to a shock generator which in turn was connected to a shock bracelet worn by the accomplice. The subject was to administer one shock (previously demonstrated to the subject to be mildly painful at 1.5 milliamps) for good work, and any greater number, up to a total of 10, for lesser work. After receiving each of the seven completed tasks, the accomplice responded with standardized written criticisms of the subject's performance that varied from mildly negative to personally insulting. After these criticisms were passed to the subject, he in turn responded by pressing the shock button which during the experiment merely activated a response counter in the experimenter's area.

Results indicated that subjects tested in conditions of environmental heat or cold delivered significantly more painful shocks (means of 3.2 and 3.5 respectively) to the insulting accomplice than did subjects tested in normal room temperature ($\bar{x} = 2.5, \rho < .01$). Aggression in hot and cold conditions did not differ significantly. It was thus deemed desirable to replicate this experiment, to compare conditions of insult against those wherein insult did not occur, and to obtain self-reports from the subjects post-experimentally.

EXPERIMENT 2

In the procedure, two subjects, one of whom was in actuality an accomplice of the experimenter were conducted to separate cubicles. The temperature of the subject's cubicle was set at one of three levels, 7.2°C, 20°C, or 32.8°C effective temperature (hot and cold were predetermined to be equally uncomfortable). He was then asked to fill out an inventory giving his opinion on ten point scales on a variety of social issues.

The procedure was then described to the subject as a study of teacher-student interaction. The teacher (accomplice) would give verbal feedback to five of the students' (subjects') responses on the social issues inventory. The subject was instructed to assess the value of the teacher's verbal feedback on each trial and to respond with "sensory feedback" of an appropriate shock intensity ranging on a push button console from 1 (mildly stimulating) to 10 (quite painful) [12]. Shock was administered to the "teacher" via finger electrodes. Approximately thirty minutes elapsed between the time the subject entered the research cubicle and the onset of the first trial. In total, sixty subjects were tested.

Five of the subjects' most extreme responses were selected from the social issues inventory. Standardized verbal feedback from the accomplice had been

pretaped for all potential subjects' responses and was broadcast over an intercom to the subject. In the insult conditions these remarks were designed to provide arbitrarily insulting feedback on the second, fourth and fifth trials; feedback on the first trial was mildly negative, and on the third was objective and neutral. In the no-insult conditions, feedback on all five trials was neutral (i.e., neither insulting or provocative).

Measures were taken of intensity of shock administered by the subject as well as his response latency (time elapsed from the end of verbal feedback and onset of a cue light, to onset of shock). Following this, the subject filled out a questionnaire which inquired, on 10-point scales, about the degree of discomfort he felt, how much he liked the accomplice, and how competent he thought he was. Then the subject was debriefed and excused.

On the measure of shock intensity, analysis of variance on the insult trial means revealed significant effects for temperature ($p < .05$) and for instigation ($p < .01$). Again, there were no differences between hot and cold conditions. But only in the hot and cold *insult* conditions was shock intensity significantly greater than that administered by normal controls ($p < .05$). Mean levels of shock intensity in these hot and cold insult feedback conditions did not differ significantly.

Thus, in two experiments, using two different measures, we have obtained the findings that both extreme environmental heat *and* cold lead to heightened aggression, but only under circumstances where the subject has been provoked by personal insult. At first glance we may conclude that any alterations in environmental temperature lead to "general arousal" [13], and that the results are contrary to the historical observations that heightened temperatures specifically ignite increased violent behavior and aggression.

Interesting differences between hot-insulted and cold-insulted subjects, however, were noted. Observation of our hot subjects revealed they appeared to be more emotionally distraught than our cold subjects, their responses were somewhat slower and analysis of the pattern of their aggressive responses indicated they discriminated less between insulting and neutral feedback, attacking their protagonist significantly more intensely on neutral trials than did cold-insulted subjects, and in a steadily increasing fashion.

THERMOREGULATION AND EMOTION

Benzinger claims that cold produces sympathetic nervous system arousal activated peripherally in the organisms, whereas thermostatic physiological reactions to heat strive to inhibit such general arousal [14]. In fact, he claims the primary mediation of the conscious sensation of heat occurs centrally in the hypothalamus (the control center for heat-loss reactions). If so, our findings may be explained by the fact that subjects tested in heightened environmental temperatures when provoked are placed in physiological conflict between the

provocation which increases arousal and the physiological reactions to heat which are working to reduce it, resulting in physiological distress and irritability. Thus, these subjects, focusing on the most salient source of their distress – the social stimulus in the form of the provocater – become increasingly aggressive. By contrast, subjects provoked in cold are sympathetically aroused and this general arousal produces quick, more appropriate social reactions without conflict involved. If so, hot-insulted subjects whose attention was drawn to the neutral but less salient environmental source of their irritation would show reduced physiological distress, less emotion and reduced aggression. Cold-insulted subjects whose aggression was not mediated by physiological conflict and emotion would be unaffected by such a manipulation.

EXPERIMENT 3

Experiment 2 was replicated with two added conditions. In these conditions, hot- and cold-insulted subjects have a large thermometer prominently placed on the panel before them indicating that the room was hot or cold. Thus, when faced with insulting feedback from the experimental accomplice under conditions of uncomfortable heat or cold, subjects could account for much of their distress by focusing on the environment rather than upon their provocateur. If cognitions regarding the source of their physiological distress mediated their aggression, they would show reduced aggression against the accomplice.

CONCLUSIONS

The findings replicated those obtained in the previous experiment in that angered subjects showed significantly increased aggression in both hot and cold environmental conditions. Thus, in three separate experiments it was found that both uncomfortable heat and cold heightened interpersonal aggression measured by both the number and intensity of shock given by male subjects to the experimenter's accomplice. These effects were obtained, however, only when the accomplice had provoked the subject by insulting him, and fascinatingly, the types of aggression exhibited under heat and cold were marked by different patterns. When uncomfortably hot, subjects took longer to respond, their intensity of aggression increased slowly and escalated over time until they were no longer discriminating between occasions when they were being insulted versus those when they were given merely neutral verbal feedback from the accomplice. This reaction was accompanied by substantial hostility toward the victim and, to risk a metaphor, appeared to reflect a "slow burn" leading to uncontrolled rage. By contrast, aggression in uncomfortable cold was swift and very specific to the degree of insult of the verbal feedback subjects received from the accomplice – in fact, more instrumental and appropriate to the situation.

Physiological measures suggest the bases for these differences. Tympanic temperature is a measure of intracranial temperature at the anterior hypothalamus [15] – the site of control for the release of norepinephrine and epinephrine – the neurotransmitters involved in both temperature regulation and aggression. Tympanic thermometer readings revealed that the subjects' intracranial temperatures dropped in cold and increased in heat [16]. However, intracranial temperature was found also to increase sharply as a response to insult in both heat and cold. And so, as we hypothesize, in heat the insult was producing a conflict with thermoregulatory processes, whereas in cold the rises in intracranial temperature were serving thermoregulation. Accordingly, in heat, the subjects' own emotional and aggressive reactions were provoking further physiological distress, culminating in his general state of emotional upset. The similarity to the explosive assaultive is striking, for in the other conditions where a large thermometer was placed before these insulted subjects, enhancing their attendance to neutral environmental causes of their distress, subjects tested in heat showed strong reductions in:

1. physiological arousal: tympanic temperature and heart rate;
2. reductions in emotion: self-reports of hostility;
3. reductions in cognition time: latency of aggression; and
4. in intensity of aggressive attack: shock intensity.

Subjects in cold were unaffected. Their aggression, emotion and physiological response curves overlapped those of cold-insulted subjects for whom no thermometer was present.

From these findings we may conclude that heightened temperature does affect violent behavior in the appropriately instigating social circumstances, by amplifying aggressive responses and possibly lowering the threshold for violence among those living in these circumstances. Through future research, the tympanic thermometer may prove useful for detecting differential thresholds for aggression among individuals as a function of learning history, environmental effects, chemical effects (e.g., drugs and alcohol), and chronic physiological stress produced by a variety of psychological and biological causes. The complexity of the relationship between thermoregulation, emotion and violence obtained in these studies under laboratory control also suggests why correlational studies with their necessarily grosser indices have produced such mixed results. Interestingly, further research may vindicate the anecdotal observations of various criminological pioneers recorded through the history of criminology.

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