WIND AS AN AVERSIVE STIMULUS¹

FREDERICK H. ROHLES, JR.

KANSAS STATE UNIVERSITY

Two monkeys were trained on an escape-avoidance procedure in which a lever press delayed exposure to wind by 20 sec. For 5 hr, subjects alternately worked 15 min and rested 15 min, and performed this schedule when the wind was 5, 10, and 20 mph and the temperatures were 50, 60, and 70° F. Analysis of variance showed that the percent of wind avoided was related to both the velocity of the wind and the temperature during the exposure. When the wind was 10 and 20 mph it was avoided almost continuously regardless of the temperature.

It is generally agreed that prolonged exposure to wind is tiring and unpleasant. This is especially true, for example, if the velocity of the wind is high and its source is a high-speed fan or blower. While this observation appears valid regardless of temperature, it holds greater credence when considering winds of different velocities under various temperature conditions. This fact may or may not be related to the maintenance of the thermal steady-state of the organism, yet it was hypothesized that under certain temperature conditions, winds of different velocities would be avoided. The purpose of this study was to test this hypothesis by using winds of different velocities as aversive stimuli in an escape-avoidance schedule usually reserved for shock.

METHOD

Subjects

Two young stump-tailed monkeys (*Macaca speciosa*), 7 lb in weight, which had not previously served as test subjects were used.

Apparatus

As shown in Fig. 1, the apparatus consisted of a wind generator, a duct and shutter device, and a test chamber. The wind generator consisted of a squirrel-cage type blower powered by a $\frac{1}{3}$ hp motor. The velocity of the wind could be changed by varying the open-

ing of a baffle at the in-take point of the blower. The blower unit, which operated continually throughout the experiment, was attached to a 9 by 13 in. (inside dimensions) plywood duct.

The duct contained two sets of solenoid-operated shutters which controlled the direction of air flow at the terminal portion of the duct. One set of shutters (Set A) was located in an opening on the top of the duct approximately 12 in. from the end; a short plywood stack protruded upward from this opening. The other set (Set B) was located inside the duct 6 in. from the end. The two sets of shutters worked as follows: if Set B was open, Set A was closed and wind would blow directly on the subject; conversely, if Set B was closed, Set A was open and the wind would blow up the stack and not reach the subject.

Immediately in front of the end of the duct was a 12 by 12 by 16 in. test chamber containing a stimulus light and lever. Wind velocity was measured at the point where the subject was responding. Programming and recording were accomplished with commercial operant conditioning equipment and all testing was conducted in the Kansas State University Environmental Chamber.

Procedure

The reinforcement schedule was an escape-avoidance contingency modified so that instead of each lever press delaying the delivery of an electric shock, it closed the shutters in Set B and opened those in Set A and delayed the onset of wind by 20 sec. Failure to press

¹Reprints may be obtained from the author. Institute for Environmental Research, Kansas State University, Manhattan, Kansas 66504.

Fig. 1. Wind generator and test chamber.

the lever at least once every 20 sec opened the shutters in Set B and closed those in Set A; under this condition, wind blew on the subject continually.

Three wind velocities, 5, 10, and 20 mph at each of three temperatures, 50, 60, and 70° F constituted the nine experimental conditions. Exposure to the nine conditions was random. The subjects were brought into the environmental chamber and were allowed to adapt to the particular temperature for 2 hr. Then, one of the subjects was placed in the test chamber for the next 15 min where it performed on the wind avoidance schedule noted above. The subject was then removed from the test chamber and the next subject was tested. Both subjects alternately worked for 15 min and rested for 15 min for the next 5 hr. Both subjects were exposed to each of the nine conditions. They were then randomly exposed to the nine conditions a second time; performances during these exposures were used in the analysis. The length of time the wind blew on the subjects was measured in tenths of seconds and the percent of time the wind was avoided for each of the 10, 15-min sessions of the nine experimental conditions was used to compute an analysis of variance.

RESULTS AND DISCUSSION

At the outset, it should be stated that the reinforcement schedule employed appeared to be quite satisfactory. During some early pilot studies, a schedule similar to a Sidman (1953) avoidance schedule was tried with an W-W interval of 3 sec. (Wind-Wind interval to correspond to Sidman's Shock-Shock interval.) However, a more stable response rate was obtained with the escape-avoidance procedure than the straight avoidance schedule. Likewise, the R-W interval (to correspond with Sidman's R-S interval) of 20 sec was selected over a 10-sec interval because the 10-sec delay resulted in almost twice as many reinforcements (blasts of air) as the 20-sec delay.

As indicated in the results of the analysis of variance, presented in Table 1, there was no significant difference in the amount of wind avoided by the two subjects. However, the variances attributed to both temperature and wind velocity and the interaction of the two were significant. The percent of the time that wind was avoided was combined for both subjects and the resulting means are presented graphically in Fig. 2. While there

Table 1

Analysis of Variance for the Percent of Wind Avoided

Source	df	MS	F
Subjects (S)	1	52.49	1.12
Temperature (T)	2	1251.02	27.95*
Velocity (V)	2	4542.56	101.49*
T x V	4	620.93	13.87*
S x T			
S x V	8	44.76	.95
S x T x V			
Samples: Subjects	18	47.42	1.01
Samples: S x T	144	47.02	
Total	179		

*P < .001

appears to be little difference between the noxiousness of the 10 and 20 mph wind, there is a great difference between the 5 and 20 mph and 5 and 10 mph winds. The reduction of the aversive qualities of the 5 mph wind when the temperature was 60° F was observed with both subjects, and is difficult to explain. The aversive properties of even a 5 mph wind are sufficiently great to cause the subjects to avoid it approximately 80 percent of the time. This finding suggests that additional research is warranted to determine the reinforcing properties of winds of lower magnitudes. In addition, the significant interaction between temperature and wind velocity suggests an extension both upward and downward of the experimental conditions to

Fig. 2. The mean percentage of time that winds of three velocities were avoided by two subjects during 10, 15-min exposures to three ambient temperatures.

include additional temperatures. But regardless of the routes of subsequent research, the results of this study clearly prove the aversive qualities of wind and its ability to control behavior. They also suggest additional research to investigate the importance of wind in behavioral thermoregulation (Weiss and Laties, 1961) and its role in the maintenance of the thermal steady-state.

REFERENCES

- Sidman, M. Avoidance conditioning with brief shock and no exteroceptive warning signal. *Science*, 1953, 118, 157-158.
- Weiss, B. and Laties, V. Behavioral Thermoregulation. *Science*, 1961, 133, 1338-1344.

Received August 11, 1964