Table 1. Effect of coatings on soil temperatures. Test was performed in Arizona for the period 25–28 October 1960. Average air temperature, 84°F (high) and 48.5°F (low); average insolation, 434 cal/cm² daily. Temperatures were recorded beneath center of 10- by 10-foot square coating.

Coating	Temperature (°F) at depths of		
	0.5 inch	1.0 inch	2.0 inch
Average maximum			
Black	114.3	106.5	100.2
Uncoated control	95.7	87.8	83.1
White	71.3	70.5	68.7
Average minimum			
Black	55.0	58.2	61.3
Uncoated control	50.6	53.9	56.2
White	48.2	49.3	52.1

thundershowers. These effects are, of course, achievable only when permitted by the atmospheric stability, humidity, and large scale flow patterns (*3*). One possible application for black petroleum coatings would be for the covering of large areas of arid land near the shoreline of a sea or large lake. This might augment the intensity of the sea breeze circulation, bringing in moist air from over the water, lifting it to its condensation level, and causing cloud formation and subsequent rainfall. Once condensation is initiated, the release of latent heat of condensation will add additional energy to the system to accelerate its operation.

An area where such an experiment might prove effective is the southern coast of the Mediterranean Sea in Libya and Egypt. Here rainfall is very low (2 to 4 inches per year), but in areas where even low hills are effective in physically lifting the air above its condensation level, significant rainfall is produced (for example, in the Bengazi Peninsula where the effect of low hills only 2000 feet high provides 20 to 30 inches rainfall annually). Other interesting areas would be in Australia or in South America at locations such as the Paraguana Peninsula.

This proposal might also have other useful applications, such as relieving smog conditions. Active efforts are under way to calculate the influence which an area coated with asphalt might be expected to have on atmospheric motions and to obtain a better idea of the economics of this technique for the initiation of rainfall (*4*).

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Skin Resistance Levels and Galvanic Skin Response: Unilateral Differences

Abstract. *On five subjects, skin resistance levels and galvanic skin response were recorded unilaterally and simultaneously from each side of the body for between 24 and 36 days. Reliable differences in skin resistance were found in three subjects and in galvanic skin response in two subjects. The magnitude of the skin resistance difference was significantly reduced in four subjects during stimulation.*

The purpose of the present study was to determine whether within a subject there were reliable unilateral differences in skin resistance and galvanic skin responses (GSR's) and the relationship between them.

In research utilizing sudomotor activity, it is common to take unilateral recordings (that is, one palmar area being the active electrode site and some nonpalmar area on the same side of the body being the reference electrode site). It has even been suggested (*1*) that unilateral recordings are preferable to bilateral, palm to palm recordings, at least for measures of skin resistance levels.

On the other hand, there is some evidence indicating that there are unilateral differences in GSR reactivity (*2*) and in skin resistance levels (*3*). If unilateral differences are a consistent characteristic of some subjects, then unilateral recordings may have less validity than bilateral recordings. That is, the degree of a subject's GSR reactivity or the level of a subject's skin resistance would, in part, be a function of the side of the body from which recordings were taken.

As yet, no systematic studies have been undertaken to determine the reliability of such unilateral differences. The present exploratory study was concerned with determining the reliability of unilateral differences in skin resistance level and GSR reactivity within a subject. For this purpose, I used an experimental design for repeated measurements.

Five healthy male Antioch College students served as subjects. They participated in the experiment at the same time each day for between 24 and 36 days.

The electrodes were zinc–zinc sulfate (1¼ inches in diameter) with one on the center of each palm and two mounted in a plastic holder within ½ inch of each other on the midline of the chest. On each day the electrodes were systematically rotated from one position to another. Two Fels dermohmmeters were used. They imposed a constant current of 70 μa. The use of two imposed currents did not create any problems, provided one Dermohmmeter was isolated from ground and no contact was made between either the electrodes or the electrode jelly on the chest.

Prior to electrode placement the skin area was treated with a half-and-half acetone-ether solution to remove dirt and skin oils. On each day of measurement, after a 30-minute hydration period, 10 minutes of recordings were taken while the subject rested with his eyes closed (rest period). After rest, approximately 13 minutes of recordings were taken while the subject performed in a serial learning task (learning period). The task was meant to be an appreciable stress; all subjects were instructed to perform at their best.

Separate measures of skin resistance level and GSR magnitude from both sides of the body for rest and learning were obtained on each day. The measure of skin resistance level was obtained by averaging the lowest point of skin resistance level for each 30-second interval of rest and learning. The GSR magnitude was the mean deflection during rest and learning of all GSR's of 600 ohms or larger. Differences between the right and left side were obtained daily on each subject for both skin resistance level and GSR reactivity. Mean differences for the entire experiment were then obtained for each subject.

Significant ($p < .05$) unilateral differences in levels of skin resistance were found in three subjects with the left side having a higher level of skin resistance in each case. An additional subject, though demonstrating no overall unilateral difference in skin resistance, did show a unilateral effect which shifted as the experiment progressed. During the first 15 days of the experiment, his left side had a higher level of resistance on 10 days during rest and on 13 days during learning. During the remaining 21 days of the experiment, the right side had a higher level of resistance on 17 days during rest and on 19 days during learning. When mean differences were determined separately for the first 15 and the last 21 days, the left side was found to be significantly higher during the earlier period (rest $p < .05$, learning $p < .01$), and the right side significantly higher during the later period (rest $p < .01$, learning $p < .01$). The basis for this shift is a decreasing level of skin resistance on the left side over the course of the experiment, but no change on the right side. No similar effect was noted in the other subjects.

Four subjects had smaller unilateral differences during learning than rest. In all four of these subjects, levels of skin resistance were higher during rest than during learning. On the other hand, the subject in whom unilateral differences were slightly larger during learning than during rest had the same level of skin resistance on the right side and slightly higher levels of skin resistance on the left side during learning than during rest. These results suggest that within an individual subject, unilateral differences on any one occasion are greater when skin resistance is high and are reduced when skin resistance decreases.

Finally, for purposes of determining the consistency between unilateral measures of skin resistance levels within subjects, rank order correlations between the left and right sides during rest and learning were obtained for each subject. All correlations were significant ($p < .01$), ranging from $+.59$ to $+.84$.

Significant unilateral differences ($p < .001$) in GSR reactivity were found in two subjects. Owing to a lack of responsiveness during rest, unilateral differences could not be determined during rest on one of these subjects, as well as on two of the remaining three subjects. During the early days of the experiment, a consistent unilateral effect, which decreased in magnitude and even reversed direction as the experiment progressed, was noted during learning with a third subject. During the first 14 days of the experiment, the left side was more reactive on 13 days, the mean being significantly different from zero ($p < .05$). During the last 15 days, the right side was more reactive on eight days, with the mean difference not being significantly different from zero. This shift resulted from an adaptation on the left side of the body and an increase in reactivity on the right side of the body as the experiment progressed.

To determine the consistency of unilateral measures of GSR reactivity within subjects, rank order correlations were performed between right- and left-side measures of reactivity during rest and learning. Out of seven possible correlations, all were positive, although only two were significant ($p < .05$).

There were appreciable day-to-day intrasubject variations in GSR and levels of skin resistance, and in unilateral differences in each. For this reason, intraindividual correlations were obtained (i) between skin resistance level and GSR reactivity on each side of the body, and (ii) between unilateral differences in skin resistance and GSR. On the basis of the large, positive intersubject correlations between GSR magnitude and level of skin resistance reported by others (*4*), we anticipated that, within a subject, (i) reactivity would be greater when skin resistance was high, and (ii) that unilateral differences in GSR reactivity would be larger when the unilateral differences in skin resistance were larger. Neither hypothesis was supported. Out of 14 possible correlations between unilateral measures of skin resistance and GSR, only one was significant ($\rho = +.35$; $< .05$). Also, only one correlation between lateral differences was significant, but in the opposite direction from what was predicted ($\rho = -.65$; $< .01$). Thus, within a subject there was little evidence to indicate that either unilateral measures of GSR reactivity or differences between the unilateral measures of GSR were related to skin resistance.

Recently, Fisher (*5*) reported that GSR reactivity is greater on the side of the body with the higher skin resistance. This result is based on comparisons made among subjects ($N = 71$). The failure to replicate Fisher's result within a subject would appear due to the fact that inter- and intrasubject analyses are not comparable. For example, one of our subjects consistently had a more reactive GSR and higher level of skin resistance on the left side of the body, but there was no relationship over the course of the experiment between each measure.

Reliable unilateral differences in level of skin resistance or GSR reactivity or both were demonstrated in four out of five subjects. It would appear, then, that in order to obtain a measure of sudomotor activity which would allow for such unilateral differences, palm-to-palm bilateral recordings would be the preferred method. In this way, each palm contributes proportionately to the total activity and the total resistance or the total response reflects the relative influence of both sides of the body. These results are consistent with those of Wilcott (*6*), who found, at best, only modest correlations between bilateral and unilateral measures of skin conductance.

The basis and meaning of such unilateral differences are not understood. The data do indicate that alerting or stressing the subject, and thus lowering skin resistance levels, decreases the size of unilateral differences in level. Other variables that might be worth consideration are handedness and hemispheral differences in electroencephalogram. In the present study, all five subjects were right-handed, and in nine out of ten comparisons, the right side of the body had a lower level of skin resistance. Therefore, it is necessary to continue investigation of this area with a larger and more heterogeneous population, at least with respect to age, sex, and psychopathology. A reduction in the number of experimental runs per subject seems justified. The reliability of sudomotor activity might be improved by taking measures from several sites on each palm (*7*).

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