Reflex modification: A method for assessing cutaneous dysfunction

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A brief and innocuous electrocutaneous stimulus applied to the lip or to the fingers altered the amplitude of reflexive eyeblinks elicited by a more intense stimulus to the forehead. The effectiveness of the initial stimulus was determined by its lead time—increasing to a maximum and then declining with an increase in the interval between the two stimuli—and by its intensity—steadily increasing with an increase in stimulus voltage. At both sites, lip and fingers, the intensities of the stimuli that approximated the sensory detection threshold (determined by a conventional method of limits) had reliable inhibitory effects on the response to the subsequent eliciting stimulus. The sensitivity of the reflex modification process to relatively weak stimuli suggested the potential value of these procedures for the objective evaluation of cutaneous loss and paresthesia. An example is provided in the history of a case in which two of three fingers that had been amputated were replanted. Ten weeks later, a test revealed that stimulation delivered to an injured finger had lost the inhibitory control it normally exerts on an intact finger.

The amplitude of the human eyeblink to auditory and to cutaneous eliciting stimuli is affected by innocuous and apparently irrelevant stimuli that briefly precede reflex elicitation (Graham, Putnam, & Leavitt, 1975; Hilgard, 1933; Krauter, Leonard, & Ison, 1973; Stitt, Hoffman, & DeVido, 1980). The present experiments were intended to describe the sensitivity of this effect and to correlate its threshold, across subjects, with the sensory threshold obtained from a simple and conventional psychophysical test. Penders and Delwaide (1973) reported that weak electrical stimulation anywhere on the face modulated the human eyeblink when the reflex was elicited by electrical stimulation of the forehead. We extended their findings by analyzing the effects of both facial prestimulation and prestimulation of the hand and examining the effects of varying the intensity of the preliminary stimuli as well as the interval between the two stimuli.

The reports that reflex behavior in humans and in laboratory animals is influenced by relatively weak preliminary stimuli have encouraged the use of this phenomenon in the development of an objective test of stimulus reception, a possibility first mentioned by Yerkes. Yerkes (1905) used reflex modification to study hearing in the frog, and Cohen, Hilgard, and Wendt (1933) and Hilgard and Wendt (1933) used these procedures to study gross visual and auditory deficits in two human patients. The empirical basis of the application of this phenomenon to sensory testing is simply that any

stimulus that can be shown to affect the amplitude of a probe reflex must have exceeded some minimal detection threshold. Its value as a test procedure is suggested by the several experiments showing that reflex modification is robust across individuals, that it occurs in response to near-threshold stimuli as determined by more conventional tests, and that known cases of sensory dysfunction can be detected with this method (see Ison, 1984). Reflex modification is being applied to the study of sensory function increasingly in the animal laboratory (Campo et al., 1985; Krauter, Wallace, & Campbell, 1981; Wu, Ison, Wecker, & Lapham, 1985; Young & Fechter, 1983), and the method may have promise in the audiology clinic as well (Marsh, Hoffman, & Stitt, 1978; Reiter, 1981; Reiter, Goetzinger, & Press, 1981). In part, the present study was undertaken to learn whether this procedure might also be used in the objective analysis of cutaneous function in humans, as a supplement to sensory evoked potentials or conduction velocities. Neither of the latter procedures is appropriate for stimuli that approximate the normal threshold for detection, and it seemed that there might be some value in an objective procedure that was suitable for these relatively weak stimuli. Data on the time course of the phenomenon and its sensitivity to stimuli that vary in intensity would provide a necessary foundation for this development. Determining the correlation across subjects between the reflex results and the results of a conventional threshold measure, which had not previously been examined, would have obvious additional value.

GENERAL METHOD

The 26 subjects were young adult volunteers with no known neurological disorders, save for one clinical patient who had accidentally amputated three fingers on his right hand 10 weeks before his

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participation and had two of them replanted (following the methods described by Meyer, 1983). Standard procedures were followed to prepare the subjects for stimulation and for electromyographic (EMG) recording of the eyeblink reflex (see Sanes & Ison, 1979). Two stimulating electrodes (Beckman miniature electrodes) were fixed 1 cm apart on the forehead over the right supraorbital branch of the trigeminal nerve, at a site where Sanes and Ison (1979) had recorded the lowest sensory detection threshold. Recording electrodes for the EMG were fixed over the inferior portion of the right orbicularis oculi muscle, one at the lateral canthus and one just ventromedial to the first. The reference electrode was placed on the temple, equidistant from the recording and stimulation sites. The impedance of the stimulating electrodes was always less than 5 k Ω , and the impedance of the recording electrodes was less than 20 k Ω . Additional stimulating electrodes were placed at the corner of the mouth or on the fingertips.

The experiments were conducted with each subject sitting in a comfortable chair placed inside an electrically isolated and sound-attenuating room (3.7 $\times$ 2.1 $\times$ 2.0 m) that had an ambient noise level of 27 dBA re 20 μ N/m². The experimenters and the control equipment were in an adjacent room from which the subject's general behavior was monitored over a television circuit and an intercom. During the experiment, the subject watched TV recordings of silent cartoons or read magazines.

The reflex blinks were elicited by a 0.5-msec square-wave pulse provided by a Grass SD5 stimulator coupled to a constant-current unit (Grass CCU1). The preliminary stimulus was a monopolar square wave of 0.5 msec duration provided by a Grass S88 stimulator (voltage rather than amperage was used to define the leading stimulus because electrode impedances at the fingertips typically were beyond the range within which the CCU1 could maintain a constant current of sufficient intensity). The elicited EMG activity was directed through an FET preamplifier and then into a Grass high-input-impedance differential amplifier (Model 7P5B, with half-amplitude settings of 30 Hz to 3 kHz), and was stored for later analysis on magnetic tape. The signal was full-wave rectified and integrated over a 50-msec epoch beginning 30 to 40 msec after the eliciting stimulus in all experiments (varying according to each subject's response latency) and, additionally, over a 10-msec epoch beginning 10 msec after the eliciting stimulus in Part A of the first experiment. The amplitude of the EMG response in volts was displayed on a digital voltmeter.

EXPERIMENT 1

A brief electrical stimulus delivered to the forehead over the supraorbital branch of the trigeminal nerve elicits a distinctive pattern of activity in the eyelid EMG. A brief response (R1) confined to the side ipsilateral to shock is seen at a latency of about 10 msec, and then a more prolonged bilateral response (R2) occurs at a latency of 25 to 50 msec or more, depending on stimulus intensity (Kugelberg, 1952; Rushworth, 1962; Shahani, 1970). In prior research we have found that if the eliciting shock was preceded by a noise pulse, the ipsilateral response was enhanced while the bilateral response was simultaneously diminished (Sanes & Ison, 1979). Both of these effects depended on the intensity of the auditory stimulus and the interval by which it led reflex elicitation. In the first experiment reported here, the preliminary stimulus was a brief shock to the lip. Our intent in the first segment (Part A) of this experiment was to describe the temporal function obtained when the preliminary stimulus was given at a fixed intensity that was near the threshold for

sensory detection, and was delivered at various lead times prior to the eliciting stimulus. The second segment (Part B) of the experiment then described the intensity function obtained when the shock to the lip was given at a fixed lead time and its intensity was varied over trials from below to above threshold values.

Method

The behavior of 10 subjects was observed, 5 in each segment. In addition to the standard recording and stimulating electrodes described above, two more stimulating electrodes were used, one at the right corner of the mouth and the other on the lower margin of the lip about 2 cm medial to the first.

In Part A, the intensities of the shock to the lip (abbreviated "S1" in what follows) and to the forehead (S2) were set individually for each subject by a brief series of trials in which the stimuli were gradually increased in intensity to determine the sensory threshold for S1 and then the response threshold for S2. The intensity of S1 that was used in the experiment was the mean voltage at which the stimulus was first detected on three successive runs. The mean for the group was 3.1 V. The intensity of S2 was set at the mean amperage on which the early component of the eyeblink (R1) occurred on three successive trials. The mean for the group was 14.2 mA. The intervals between S1 and S2 were set at 5, 50, 100, 150, 200, and 250 msec. The subjects received a total of 49 trials, seven in each of seven conditions. Six conditions consisted of the S1-S2 pairs at the various interstimulus intervals, and the seventh was a control trial consisting of S2 delivered alone. The order of trials was given by a 7 $\times$ 7 Latin square, so that every condition was given before any was repeated. Following these 49 trials, the detection threshold for S1 was again calculated from the method of limits, this time from a series of five ascending and five descending runs, intermixed, in which the intensity of the shock was increased (or decreased) until the subject first detected the stimulus (or failed to detect it). The mean of the 10 values defined the threshold. The method of limits was chosen for comparison with reflex modification because it is representative of procedures that might be used in the clinic and because it could be rapidly and simply completed by our naive subjects.

In Part B, the interval between S1 and S2 was set at 80 msec and the intensity of S1 was varied, at 1.5, 2.0, 2.5, 3.0, 3.5, or 4.0 V. The intensity of S2 was set using the same presentations as in Part A, except that it was required only that R2 be elicited by the stimulus. This component of the response has the lower threshold (Sanes, Foss, & Ison, 1982), and for the group as a whole the mean was 3.6 mA (14.2 mA was observed in Part A). Otherwise, the procedures used in Part B duplicated those used in Part A.

Results

Part A. Figure 1 depicts the mean R1 and R2 amplitudes for the baseline S2-alone condition and the six S1-S2 paired conditions. As has been shown previously with auditory and visual stimulation (Sanes, 1984; Sanes & Ison, 1979), the effect of the leading tactile stimulus was to enhance R1 and simultaneously to depress R2. Analysis of variance showed that both facilitation and inhibition were reliable [$F(6,24) = 4.40$ and 6.53, respectively, $p < .01$]. Facilitation peaked at 50 msec for each of the subjects; inhibition peaked at 50 msec for 4 subjects and at 100 msec for the fifth. Examination of the data obtained for each individual revealed that facilitation, although descriptively present in all 5 subjects, was significant only in 2 ($p < .05$), whereas inhibition was both present and significant in all 5. At the conclusion of the reflex tests,

the mean detection threshold for lip stimulation was 3.2 V, thus approximating the value found earlier.

Part B. The outcome of this segment of the experiment is shown in Figure 2. When the eliciting stimulus was preceded by shocks to the lip set at intensities of 1.5 and 2.0 V, the eyeblink responses were not different from the control value, but reflex amplitudes were reduced by an S1 set at 2.5 V and were reduced further with higher settings. The analysis of variance of these data provided a significant effect of stimulus intensity [$F(6,24) = 14.02$, $p < .01$]. For the group as a whole, stimulus intensities of 3.0 V and above provided significant inhibition of the response ($p < .01$). The number compares reasonably with the group mean detection threshold (2.8 V) determined by the method of limits. Each of the 5 subjects provided a function similar to that shown in Figure 2, and each showed reliable inhibition of the response at some intensity of S1 ($p < .05$). The lowest intensity at which inhibition was reliable and the average detection threshold for each subject are given in Table 1. The correlation of these pairs of numbers was +.85.

In summary, the data obtained in the first segment suggest that the bilateral component of the eyeblink reaction is the better target for reflex modification—reflex inhibi-

Figure 1. Mean response amplitudes (summed EMG) for R1 (top) and R2 (bottom), related to the temporal interval in milliseconds between a near-threshold shock to the lip (S1) and the reflex-eliciting shock to the forehead (S2). At the point labeled C, only S2 was presented. (Experiment 1, Part A.)

Figure 2. Mean response amplitudes (summed EMG) for R2 elicited by a shock to the forehead (S2) related to the intensity of a shock to the lip (S1), at a fixed interstimulus interval of 80 msec (Experiment 1, Part B).

tion of R2 occurred over a wider range of interstimulus intervals and was more robust across subjects than was reflex facilitation of R1. In addition, because the bilateral component can be elicited at lower stimulus intensities than those necessary to elicit the ipsilateral component, the test for reflex inhibition can proceed with stimulus intensities that are relatively weak and entirely innocuous even, in our experience, for our most apprehensive subjects. Because of these considerations, only the second bilateral component of the eyeblink reflex was used in Part B of this experiment and in the next experiment. It is important to note, however, that the basic findings concerning the sensitivity of the procedures to near-threshold stimuli were apparent in both segments of the experiment. This reveals that the intensity of the eliciting stimulus is not a critical determining factor for the sensitivity of reflex inhibition to near-threshold stimuli, at least within the present range of stimulation.

The data obtained in Part B of this experiment reveal that the eyeblink was inhibited by a shock to the lip that approximated the sensory detection level, and that individual differences in sensitivity to lipshock appeared to affect both sensory judgments and reflex modification. The implication of the correlation (which will gain in stature with the increase in the number of observations obtained in the second experiment) is that a substantial contribution to the individual differences in reflex modification derives from individual differences in the appreciation of the stimulus rather than, for example, only differences intrinsic to the reflex mechanisms responsible for inhibition.

EXPERIMENT 2

In the second experiment, we extended the findings of Experiment 1 by using electrical stimulation of the finger as the preliminary stimulus. As far as the temporal func-

Table 1
The Voltages at Which Reliable Reflex Inhibition Was Present (RI)
and the Sensory Threshold Defined by the Method of Limits (ML)
for Each of the Subjects in the Two Experiments

	Experiment 1		Experiment 2	
	RI	ML	RI	ML
	3.5	3.3	15	15
	3.0	2.7	15	22
	3.0	3.2	20	16
	2.5	2.1	25	15
	3.0	2.5	25	16
			25	24
			40	25
			40	29
			(>)40	28
Mean	3.0	2.8	(>)27	21

tion was concerned, it seemed reasonable to assume that the appearance of inhibition from electrical stimulation of the finger would be relatively delayed compared with that from stimulation of the lip, simply because some portion of the temporal function must reflect the greater length of the afferent neural pathway taken by the preliminary stimulus delivered to the fingertip. In contrast, while it could be anticipated that the inhibitory effect of shock to the finger would be directly related to its intensity, whether the eyeblink reflex would be affected by near-threshold shocks to the fingers was uncertain. It is possible that the neural processes for the preliminary stimuli to the lip and the eliciting stimuli to the forehead are preferentially related to each other because of their common trigeminal representation, and this relationship may have been responsible for the sensitivity of the blink reflex to near-threshold perioral stimuli. The presence or absence in the group data of reflex inhibition to near-threshold stimuli presented to the fingers thus has some general interest, in addition to the continued interest in the relationship between detection thresholds and inhibition thresholds across subjects.

Method

Fifteen subjects participated in this experiment, 6 in Part A and 9 in Part B. In addition to the standard electrode placements on the forehead and eyelid, two more stimulating electrodes were fixed to the first two phalanges of the right index finger. Gold-plated cup electrodes were used, held in place by tape. The impedance between these two electrodes typically exceeded 50 k Ω . For both segments of this experiment, the intensity of S2 was set with the procedure used in Experiment 1, Part B. In Part A of the present experiment, the mean intensity for S2 was 8.3 mA; in Part B, the mean was 3.7 mA. In contrast to Experiment 1, no attempt was made to use a near-threshold value for the preliminary stimulus in Part A, because of the possibility that the stimulation of the lip might have had some special potency in modifying the eyeblink reflex, a potency not shared by stimulation of the fingertip. Instead, the level of S1 was set arbitrarily at 40 V for all of the subjects, a value known to be innocuous but clearly above threshold. In Part A, the S1-S2 intervals were varied and were set at 5, 50, 100, 150, 200, and 250 msec. Again, 49 trials were given, 7 S2-alone control trials and 7 in each of six paired S1-S2 conditions.

Before starting the experimental series in Part B, each subject received three series of trials in which the intensity of the shock

to the finger was gradually increased from trial to trial, starting from a below-threshold value, and three series in which the intensity was decreased, starting from an above-threshold value. The mean of the first detection on ascending runs and the last detection on descending runs defined the threshold for finger stimulation. The interstimulus interval was set at 125 msec. The intensities of S1 were set at 15, 20, 25, 30, 35, and 40 V. Otherwise the procedures used in the two segments of the experiment were identical.

Results

Part A. The temporal function relating reflex expression to the interstimulus interval is given in Figure 3. Inhibition was generally more pronounced in this experiment than in the comparable procedure of Experiment 1, but, as anticipated, it developed to its maximum more slowly. Analysis of variance produced a significant effect for temporal conditions [$F(6,24) = 13.49, p < .01$], and all values beyond 50 msec were significantly different ($p < .05$) from the baseline. Peak inhibition occurred at intervals of 150 msec for 3 subjects and 200 msec for the others. At the conclusion of the reflex trials, the mean threshold for detecting fingertip stimulation was 21.4 V, which was considerably less intense than the 40-V preliminary stimulus that was used in this experiment. The fact that, in contrast, the preliminary stimulus was close to the detection threshold for lip stimulation in Experiment 1, Part A, provides a plausible explanation for the observation that inhibition was substantially weaker in the earlier experiment.

Part B. The function relating reflex expression to the intensity of the initial stimulus is given in Figure 4. As is common in these experiments, inhibition increased with an increase in stimulus intensity. Analysis of variance produced a reliable effect for stimulus intensity [$F(6,48) = 6.86, p < .01$], and all intensities of 20 V and above reliably inhibited the response ($p < .05$). The reliability of inhibition at 20 V, which compares favorably with the obtained detection threshold of 21.4 V, again reveals the sensitivity of reflex modification to near-threshold stimuli, and indicates that the data obtained in Experi-

Figure 3. Mean response amplitudes (summed EMG) for R2, related to the temporal interval in milliseconds between a 40-V shock to the finger (S1) and the reflex-eliciting shock to the forehead (S2). At the point labeled C, only S2 was presented. (Experiment 2, Part A.)

Figure 4. Mean response amplitudes (summed EMG) for R2, elicited by a shock to the forehead (S2), related to the intensity of a shock to the finger (S1), at a fixed interstimulus interval of 125 msec (Experiment 2, Part B).

ment 1 did not depend on some special relationship that happened to link two sorts of facial stimulation.

Of the 9 subjects who participated in this part of the experiment, 8 showed reliable inhibition ($p < .01$). The 1 aberrant subject provided an intensity function like that depicted in Figure 4, but the inhibited values did not significantly depart from the control value because her control responses were unusually variable. At the conclusion of the experiment, she reported that she had been falling asleep during the session, which possibly accounts for the variability in her scores.

The lowest intensity at which inhibition was reliable for each subject and the associated average detection threshold are given in Table 1. The correlation between the two measures was $+ .76$ [$t(7) = 3.09$, $p < .05$]. The difference between the mean voltage at which reliable inhibition occurred and the mean thresholds from the method of limits was significant [$t(8) = 2.59$, $p < .05$]. It can be seen that for 7 of the 9 subjects the detection threshold was the lower value; this was found also for 4 of the 5 subjects in the first experiment. This difference suggests that for the individual subject the conventional method of limits provides the more sensitive index of stimulus reception, as compared with the stringent criterion of "statistically reliable" inhibition, although the sensitivity of the reflex test could be enhanced by increasing the power of the test by, for example, increasing the number of observations. The analyses of the grouped data provided by the subjects in the two experiments suggest that the overall sensitivity of the method approximates that of the conventional psychophysical method. The correlation in the sensitivity of the two measures across subjects was again substantial, and the two correlations taken together ($+ .93$ for the combined data) suggest that a substantial share of the between-subjects variance in reflex inhibition resulted from differences in cutaneous sensitivity.

CASE REPORT

A sheet metal worker had amputated three fingers from his right hand in an industrial accident 10 weeks previously. Two were replanted (Meyer, 1983) and one of them, the ring finger, was tested to see if stimulation at normally effective intensities had any effect on reflex expression. The general procedure followed that used in the second experiment. The purpose of this analysis was to provide a "positive control" for the method; that is, the goal was to take a known pathological example and test to see whether the differences in reflex inhibition between normal and pathological conditions could be demonstrated. This case was additionally interesting because at this time, 10 weeks after surgery, the patient reported that he was experiencing some general impression of tingling in the replanted fingers. At the same time, however, he could not be sure that any particular tactile sensation was related to the presence of a discrete stimulus, and the two-point threshold could not be obtained.

Stimulation of the ring finger on the left hand was used as the control. The general procedure for electrode placement was taken from the second experiment, with the exception that stimulating electrodes were placed on the ring fingers of both hands. Three different stimulus intensities for S1 were used, 24, 32, and 40 V, delivered to the right or the left hand 125 msec before the shock to the forehead which elicited the eyeblink response. Each of the seven conditions (3 intensities $\times$ 2 hands, plus the S2-alone control trials) was given seven times in the 7×7 Latin square design.

The average amplitude of the response on control trials was 310 units (in arbitrary units, linearly related to integrated voltage). When the shock to the forehead followed the shock to the ring finger on the left hand, the mean reflex amplitudes dropped to 140, 130, and then 118 units for 24, 32, and 40 V, respectively. In contrast, when the shock to the forehead followed the shock to the right ring finger, the mean reflex amplitudes were 324, 290, and 324 units. Analysis of variance of these data provided a significant effect of laterality [$F(1,36) = 59.97$, $p < .01$]. Reflex depression was significant when the left hand was stimulated ($p < .05$), but not when the right hand was stimulated ($F < 1$). Figure 5 depicts a set of tracings of trials from a row in the Latin square design. The tracings are of single trials from the storage oscilloscope and are characteristic of the general outcome of these experiments. The amplitudes of the eyeblink reflexes to forehead stimulation that followed shock on the right ring finger were about equal to the response on the S2-alone control trial, whereas all of the responses to forehead stimulation that followed shock on the left hand were depressed. This difference is objective evidence that cutaneous sensitivity of the right ring finger remained abnormal 10 weeks after surgery.

Although, in this case, the sensory loss would be un-

Figure 5. Electromyographic activity in orbicularis muscle on a control trial (S2 alone) and on trials in which S2 was preceded by three different intensities of S1, at two locations: 24-, 32-, or 40-V stimulation of the left (intact) or right (injured) ring finger (case report).

mistakable regardless of the method used to test it, the reflex method did not require that the patient attend to the stimuli or be cooperative about providing a voluntary sign that the stimulus was detected—that is, besides its sensitivity, the procedure has the advantage of the objective electrophysiological tests in being invulnerable to the individual's motivational state or expectations. It is also of interest that this very cooperative man was uncertain about whether or not he could detect the presence of normal cutaneous stimuli against a background of endogenous sensations. The absence of reflex suppression occasioned by these test stimuli suggests that he could not.

DISCUSSION

We have previously reported that auditory and visual prestimuli enhance the unilateral component of the human eyeblink, R1, while the second bilateral component (R2) is simultaneously depressed (Sanes, 1984; Sanes & Ison, 1979). In the present experiments, these earlier findings, and the findings of Penders and Delwaide (1973), were extended to show that electrocutaneous stimuli to the lip and to the hands have similar effects. The magnitude of these effects was determined by the intensity of the initial stimulus and by the temporal interval between it and the eliciting stimulus, which is the typical finding (Hoffman & Ison, 1980). In comparing the effects of lip versus finger stimulation, it was not surprising that the onset of inhibition with the increasing S1–S2 interval was delayed when the fingers were stimulated, contrasted with stimulation of the lip, because of the longer afferent pathway between the finger and the central reflex control mechanisms. It is important to note, however, that the eyeblink reflex was equally sensitive to the effects of finger and lip stimulation. In both cases, stimuli that were approximately at the sensory detection threshold, as determined by the conventional method of limits, suppressed the reflex.

It is commonly understood that the outcomes of the different methods for assessing sensory function are determined only in part by underlying sensory processes. The results of each method are affected by more or less unique factors which have to do with the determiners of the response system on which the test depends—for example, by decision rules or response biases in such classic conventional psychophysical tests as the methods of limits or constant stimuli. Just as individual differences in these response processes can affect the outcome of the psychophysical tests, individual differences in the mechanisms responsible for reflex control can affect the outcome of a reflex inhibition test applied to the study of sensory processes. If reflex inhibition were driven to some considerable extent by non-sensory mechanisms that varied across individuals, its application to the study of sensory processes would be limited. In this context, it is important that reflex inhibition was reliably obtained with stimuli close to the sensory threshold and that fingertip stimulation and lip stimulation were equally potent inhibitors. It is also important that overall, despite the wide differences in methodology, individual differences in sensory threshold obtained from the method of limits accounted for over half of the variance in the thresholds for reliable reflex inhibition.

The reflex methodology used in these experiments is being used with increasing frequency to study sensory function in the laboratory with both humans and laboratory animals. It is a valuable test because the behavioral evidence of stimulus detection is objective and the behavioral phenomenon on which it is based does not depend on any special motivating instructions or training regimens. Thus it can be used with “difficult-to-test” populations that may be inarticulate or that will not or cannot cooperate in the typical test procedure (Reiter et al., 1981). An additional advantage is that the techniques and the equipment for eliciting reflexes are widely available and can be readily adapted to study reflex modification by preliminary stimuli.

Electrophysiological tests of nerve conduction and evoked potentials are in common use for characterizing the neurological disorder underlying sensory dysfunction (Daube, 1980). Our use of the reflex inhibition methodology has emphasized its providing an objective measure of sensory function for stimulus intensities that approximate the detection threshold. The measures obtained from reflex inhibition tests might supply an objective psychological complement to the neurologically relevant information available in the electrophysiological tests.

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