A METHOD OF TESTING CONTACT PLACING REACTION IN THE CAT

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Abstract. The paper describes a device for testing contact placing in the cat which allows to control, with relatively high accuracy, the duration of tactile stimulation, its strength and the reaction time of contact placing. The apparatus can be used for testing contact placing in different experimental situations.

Contact placing (CP) belongs to a basic repertory of postural reactions in the cat and other mammals (3, 5, 6). It is elicited by a light touch on the distal part of an unsupported limb and consists of placing the stimulated extremity on a touching object. Although CP has been widely used for estimating motor deficits following lesions of the central nervous system, it is usually tested in a way which hardly allows its isolation from other reactions accompanying CP or the detection of its parameters (1, 2). When forelimb CP is tested the animal is conventionally held horizontally with the head tilted upwards and one limb freely pendant, and moved toward the source of tactile stimulation until the paw touches it (for detailed description see 1). Thus, the way of holding the animal by the experimenter might produce additional postural reactions, e.g., tonic labyrinthine and neck reflexes elicited by the position of the head (5), chin placing reactions produced by tactile stimulation of the chin and lower parts of the face or even visual placing evoked by visual cues while the animal is moved with only
partly covered eyes (3). All these reactions might influence CP in many different ways. On the other hand, reported attempts to test CP under better controlled experimental conditions, i.e., in partly immobilized animals, were unsuccessful since they led to struggling followed by a reduced probability of eliciting CP (1).
Fig. 3. A contact placing reaction tested in an animal positioned in the hammock with the device described in the text. A, application of the tactile stimulation to the lateral side of the forepaw. The inset below shows an expanded view (×2.5) of the stimulating end of the lower plate. B, the final position of the stimulated paw on the landing plate.

Fig. 4. Block diagram of the signal flow from the device.

In order to overcome the disadvantages of the conventional way of CP testing we have modified its procedure. The animals were positioned in a canvas hammock spread flat over a frame of 75 × 80 × 110 cm. The hammock was designed so that all of the animal’s limbs hung freely and that it could not see them (Fig. 1). The animal’s body was
restrained in the jacket attached to the hammock and both the hammock and the jacket fitted the animal. Cats were accustomed to remain quietly in the hammock over a period of several weeks until they would readily remain in it for more than 1 h.

The CP reaction was induced with the device shown in Fig. 2. The lower ("stimulating") plate of the apparatus was equipped, at its narrow end, with a small brush which was used to stimulate one side of a limb. The experimenter gently moved the brush along the distal parts of the limb in the direction of the toes (Fig. 3A). If the stimulation was followed by a CP reaction, the animal placed the paw on the upper ("landing") plate of the device (Fig. 3B).

The device allowed not only to elicit but also to measure some parameters of the placing reaction. Both plates were equipped with strain gauges with sensitivities of 0.3 V/G and 0.06 V/G for the landing and the stimulating plates, respectively. Signals from the sensors were amplified 1,000 times for the landing and 5,000 times for the stimulating channels. They were compared to reference voltage set at the lowest possible level to eliminate accidental vibrations: at about 150 μN (15 mG) for the stimulating plate and 39 mN (4 G) for the landing plate. The signals, compared with the reference voltage, were transformed into 3 standard pulses of different amplitude and polarity and used to
produce a common output (output 1 in Figs. 4 and 5). The first two pulses indicated the beginning and the end of tactile stimulation and were determined by the onset and the termination of the deflection of the brush. The latter event did not necessarily correspond to the beginning of the motor reaction which might appear either during the tactile stimulation or after it. The third pulse indicated the beginning of placing of the paw on the upper plate of the device. Thus, the interval between the first two pulses corresponded to the stimulation time and the interval between the first and the third pulse indicated the CP reaction time. These three pulses were easily discriminated by a window trigger and used to construct histograms of CP stimulation and reaction times using an Anops 101 analyzer. In order to estimate the strength of the stimulus, the analog output of the amplifier was used (output 2 in Figs. 4 and 5). The voltage output of this amplifier was linearly related to the force exerted on the brush of the lower plate within the range from 0 to 49 mN (5 G) (Fig. 6).

Control testing of accuracy of the device showed that maximal errors in marking the beginning and the end of tactile stimulation and landing of the paw were +4 ms, −3 ms and +5 ms, respectively. These errors were relatively small compared to the inaccuracies produced by the equipment used in other, similar experiments (1, 2).

The described device can also be used for testing and measuring CP parameters in animals held in a conventional way. It is then rigidly
attached to a table and the animal is moved until the pendant paw is brought in contact with the stimulating plate of the apparatus. The differences in the results obtained under both experimental conditions will be described in the following paper (4).


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