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IVANOV-SMOLENSKY AND OPERANT CONDITIONING: AN HISTORICAL NOTE

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"The operant method has been popularized by Skinner and his students, but the initial systematic studies of operant conditioning with children were conducted by Ivanov-Smolensky."

—H. W. STEVENSON (1970)[2]

This statement was inspired by a 1927 article in *Brain,* a British journal of neurology.[3] Recent findings have rekindled interest in whether certain behaviors are products of stimulus-response, stimulus-reinforcer or response-reinforcer dependencies. The discourse was initiated by Skinner in 1937, when he identified a functional response class called "operant" in his *Reply to Konorski and Miller.* The article reprinted below predates that conceptual breakthrough by 10 years . . . and it shows.

Ivanov-Smolensky considered the differences between his technique and that of his colleague, Pavlov, inconsequential. Skinner would, in 1938, point out and clarify the importance of the difference for all time in *The Behavior of Organisms.* Ivanov-Smolensky had made a food reinforcer contingent in order to maintain responding, establish discriminations, and allow generalization testing. Today, the analysis of the variables that account for these phenomena is still to be completed.

Anatoly Grigorievitch Ivanov-Smolensky described his apparatus and procedures in several publications *circa* 1927. They have been used to study the behavior of normal and damaged children in the U.S.S.R. ever since. The simple elegance of the technique makes one wonder why it was not widely adopted outside of the Soviet Union. More than likely, the article was overshadowed by the appearance, in the same year, of Anrep's translation of Pavlov's collected studies.

ON THE METHODS OF EXAMINING THE CONDITIONED FOOD REFLEXES IN CHILDREN AND IN MENTAL DISORDERS

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The work on "Conditioned Food Reflexes in Children" was begun in Russia twenty years ago by N. I. Krasnogorsky, one of Professor Pavlov's pupils.

Krasnogorsky studied the conditioned motor reflexes in the form of opening the mouth and swallowing after associating different optic, acoustic and skin signals with feeding.

He mainly examined small children. Lately, Miss E. Mateer, an American, has made use of Krasnogorsky's method on a great number of children.

In the course of the last two years the following methods for the study of conditioned motor reflexes in children, aged 5 to 12, have been applied in my laboratory at the Hertzen Pedagogical Institute, and also at the Military Medical Academy:—

Through a wall of the experimental room in which the person to be examined is placed, a sloping metal tube is constructed (length 55 cm., diameter 3 cm.), *NN'* (fig. 1).

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[2]Stevenson, H. W. Learning in Children. In P. H. Mussen (Ed), *Carmichael's manual of child psychology,* Vol. I. 3rd ed.; New York: John Wiley & Sons, 1970. Pp. 856.

[3]Reprinted here with the permission of Oxford University Press.

On the side of the experimentater the slide is closed by a simple photographic shutter which is connected: (1) with a signal (*D*); and (2) with a rubber bulb (*R*). By pressing this bulb the experimentater opens the upper aperture (*a*) of the tube NN′; at the same time the shutter puts the signal into action, and thus the moment of opening can be registered on the kymograph.

In front of the opening there is a small sloping shelf (*L*) on which the experimentater places a piece of chocolate. When the shutter opens the chocolate falls into the tube and quickly moves to the lower opening (*a′*). Here also there is a photographic shutter which is opened by a rubber bulb (*R′*); the latter is held by the person being examined; it is connected not only with the shutter but also with a Marey tambour (*M*), and when the person being examined presses the bulb to open the shutter that movement is registered on the kymograph by a manometer, or by a special apparatus which indicates the force of the motor reflex of the hand.

The upper wall of the metal tube in its lower third has a glass plate (*V*), allowing the person that is being examined to see the moving chocolate. In front of the lower opening of that slide there is a metal saucer, upon which the chocolate falls when the shutter is opened.

Fig. 1 is a drawing of this apparatus.

The experiment is made in the following way: The child sits in front of the lower shutter of the apparatus in such a manner that he faces the glass part of the tube with the rubber bulb (R′) in his hand. While the chocolate is moving in the tube past the glass (V), the experimentater presses the child's hand and thus also the bulb held in his hand. Having done so several times he succeeds in teaching the child to press the bulb every time he sees the chocolate in the tube. The chocolate when it falls into the saucer is at the disposal of the child and the latter eats it at once.

When the child has become accustomed to deal with the apparatus, the experimentater begins to form the grasping conditioned reflex (as squeezing) to a bell, to the lighting of an electric lamp, to some tactile stimulation, &c. For instance, after having started the ringing of an electric bell, two or three seconds later he adds a food stimulus to the sounding of the bell by opening the upper shutter and allowing the chocolate to slide down, which the child receives by opening the lower lock.

After several times ringing the bell and giving food simultaneously, a motor reaction

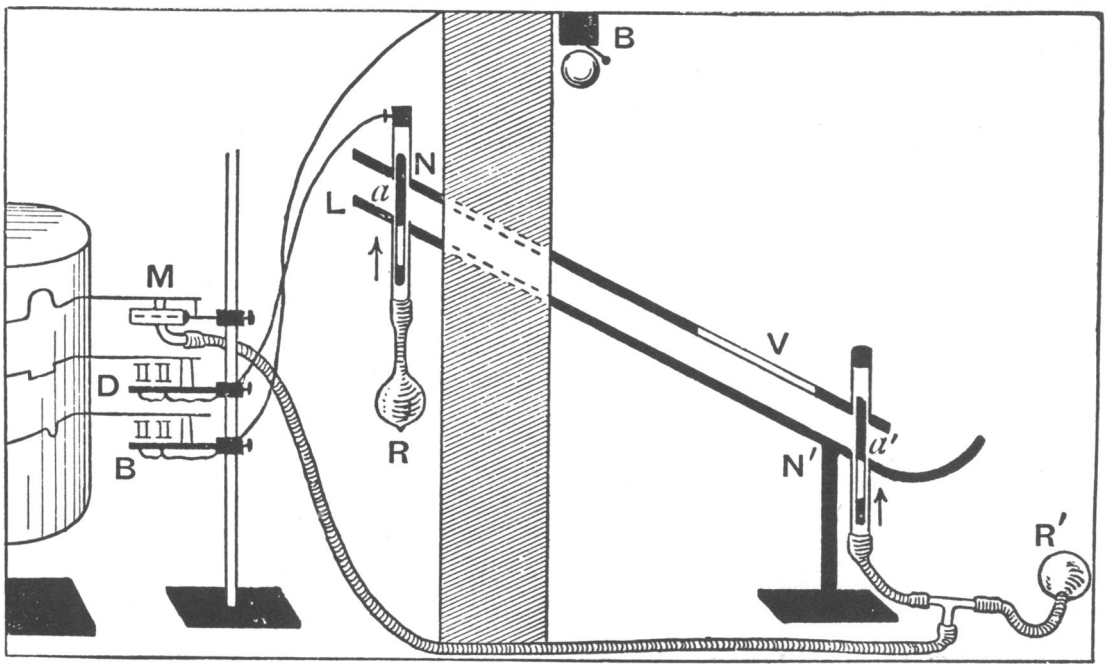

Fig. 1.

(pressing on the bulb) is noticed in response to the sounding of the bell, i.e., a conditioned motor reflex has been formed. The latent period of the seizing reflex is measured either by means of a stopwatch, or when a kymograph can be applied by means of a Jaquet chronograph.

The intensity of the conditioned reflex (the force applied by the child in squeezing the bulb) is registered in the above-mentioned way by a manometer, or by means of a Marey drum and a kymograph. The conditioned signal and the feeding are registered by a Deprez signalizer.

Records of conditioned (bell) and unconditioned (food) reflexes with the responsive reactions of the child are found in the following diagram (see fig. 2).

The intervals between the single stimuli (bell, feeding) were varied in duration from 0.25 to 2 minutes.

If, after having established a conditioned reflex, we apply several times the conditioned stimulus (bell) without feeding, the latent period begins to increase gradually, the intensity of the reflex (i.e., the force of pressure on the bulb) decreases and finally the reflex disappears, i.e., the conditioned reflex is extinguished.

When the conditioned reflex to bell A had been formed, we generally, in consequence of the process of generalization, obtained the same reaction to other bells: B, C, D. If every time while feeding with bell A we applied from time to time bell B, always without accompanying the latter by feeding, we soon attained differentiation: A produced a conditioned reflex, while B destroyed it, i.e., an inhibitory effect was produced (a negative or inhibitory conditioned reflex).

If we combined every time the sounding of an electric bell with feeding, while a combination of that bell with the switching on of an electric light was not accompanied by a gift of chocolate, we transformed the electric lamp into a conditioned inhibitor; at the same time the bell ceased to produce a reaction.

By continuing to sound the bell for ten to fifteen seconds (instead of two to four seconds) the reaction was retarded and the conditioned reflex appeared only by the eighth or fourteenth second.

Thus we can study all four kinds of internal inhibition in children: the extinguishing, the differentiating, the conditioned and the retarded inhibition. If we introduced different external stimulations while a certain conditioned stimulation was acting, we could observe conditioned inhibition.

Experiments have been performed in my laboratory (Novikova, Fadeeva, Hackel, Ronczievsky and Aksenov) on the highest nervous activity of children, aged from 6 to 12 years, and on the speed and durability of forming positive and inhibitory conditioned reflexes (i.e., on differentiating, on conditioned inhibition and on delayed reflexes).

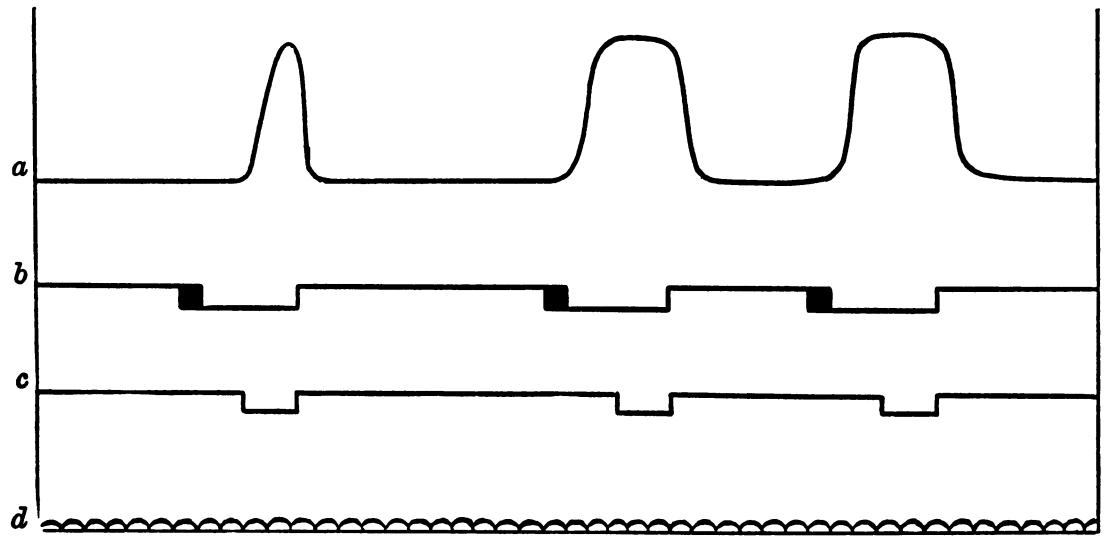

Fig. 2.—*a*, Conditioned motor reflex. *b*, Conditioned stimulus (bell). *c*, Food stimulus (chocolate). *d*, Time register.

These experiments have proved that we can distinguish three groups of children: (*a*) children with a healthy nervous activity in whom positive and inhibitory conditioned reflexes are formed quickly and remain stable; (*b*) children with feeble internal inhibition, i.e., those in whom nervous irritation is predominant; (*c*) children in whom cortical inhibition is more prominent than irritation (Novikova, Bronstein, Hackel).

At present we are investigating the functional value of the cerebral hemispheres, and the peculiarities of age and type of the nervous activity of children aged from 5 to 15 years.

We are now successfully applying the methods described above, as has been proved by experiments, in examining the conditioned reflexes of some categories of individuals in imbecility, mental debility, schizophrenia and general paralysis.

Thus by means of the method here described we can examine the grasping conditioned reflex, which is a reaction of apparently great biological importance.