NOVELTY AS A STIMULUS OF SPECIAL REACTIONS

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Since the time when it was shown that any change in the conditions or experimental arrangement constitutes quite a strong stimulus, the problem has been to find which reactions occur in response to novelty.

It is known that there are stimuli which evoke special reactions, which may be inborn or acquired, as for instance, feeding, defensive, and other reflexes. Also, the most varied stimuli may be effective in eliciting the common reaction usually referred to as the orienting reflex [1-4 and others]. Novelty, as a stimulus, evokes this reaction, whose effector component consists in adopting a position in which the receptor organs are directed towards the stimulus source.

In his last researches, L. P. Pavlov noticed that novelty also brings about a special reaction. This result is shown most clearly in studying the reflex of alertness, or the passive defensive reflex. It was found that under certain conditions novelty brings about a special reaction, the alerting reflex, and that this is accompanied by a generalized reaction — the orienting reflex [4].

Given that there is this response, the problem then arises as to how this complex behavior in response to novelty may be broken down into separate components; it becomes necessary to study the alerting reflex and its relation to the orienting reflex in cases when they both occur simultaneously in response to the same stimulus.

We have based our approach on the fact that in whatever reaction is being performed by the animal, it is always possible to discern a generalized reaction, i.e. one in which the receptor organs are directed towards the position of the stimulus. When other stimuli come into play, the extent to which the orienting reflex is mobilized and directed is less; but when such other stimuli are not present, although only the merest trace may be noticeable, the orienting reflex will always act so as to favor the perception of the usual stimuli associated with the set-up of the experiment.

When a dog is placed on a stand which has been moved to a new position, the limitation imposed on its movements facilitates the development of the alerting reflex. If the stimulus is placed to one side of the animal, it will then be possible to establish a temporary association between the development of the alerting reflex and the mobilization of the orienting reaction. To demonstrate that novelty in the form, for instance, of a new stimulus elicits first of all a special reaction, the alerting reflex, and that this is accompanied by a generalized reaction — the orienting reflex [4].

In order to enable a more precise description of the reaction of a dog to novelty to be made, we recorded the respiration and the electrical activity of the brain. During the action of the new stimulus, the respiration
Fig. 1. Increase in the degree of synchronization in response to food being offered in the way to which the dog is accustomed. Electroencephalogram recorded by G. G. Sakhalinina's method.

Curves, from above downwards: stimulus trace; electroencephalogram recorded from premotor region of left hemisphere, sensory motor region of right hemisphere, parietal area of left hemisphere, occipital area of right hemisphere; time marking (1 second).

Fig. 2. Increased synchronization on giving new stimulus in unaccustomed setting. First application of the new stimulus — the bell.

Curves as in Fig. 1.

Alternates. During the first applications of the stimulus, the respiratory component of the alerting reflex consists of an arrest or of a delay in the respiration, and this is observed in most cases in experiments carried out on different dogs.

When a new stimulus is used in surroundings to which the animal is unaccustomed, considerable changes in the electrical activity of the brain occur; they resemble those which are found in the usual set-up when a natural conditioned or unconditioned stimulus is applied, such for example as when the receptor organs are turned towards the feeding trough, and the animal's food reaction to being given rusk occurs. Thus, in Fig. 1, it can be seen that when the feeding trough is offered to the animal, which then begins to eat, synchronized electrical potentials occur immediately. This change occurs in one case when the potentials composing the electroencephalogram (EEG) become desynchronized, and in another case when they become synchronized. In both instances, the manifestation of the food reaction is associated with an increased synchronization of cerebral electrical activity.

The first time that a new stimulus, placed behind the dog, is given, the result is an immediate and considerable variation of voltage amplitude. The EEG corresponding to this experiment is shown in Fig. 2. The electrical oscillations represent a greater degree of synchronization of cerebral electrical activity during the development of the alerting reflex. As was the case with the reaction to being offered food, the degree of the synchronization increases independently of the normal background electrical activity of the brain of the animal in the waking state.

Thus, a single stimulus, either old or new, elicits simultaneously both the generalized orienting and the directed special reaction, for example the feeding or the alerting reaction. Modifications of these experiments showed that the orienting reflex does not inhibit this special reaction. Here we refer to experiments in which