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journal or publication title	Tohoku psychologica folia
volume	36
page range	9-14
year	1978-03-20
URL	<a href="http://hdl.handle.net/10097/00064918">http://hdl.handle.net/10097/00064918</a>

## INHIBITORY EFFECTS OF A READY SIGNAL ON EYELID CONDITIONING

By

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The purpose of the present study was to investigate the effect of a ready signal (RS), especially the length of the RS on the eyelid conditioning. 92 subjects were divided into five groups, that is, 3 groups with the RS (200, 500 and 1000 msec.), a group with the lengthening CS and a group without the RS.

Main findings were as follows: when the RS was constantly presented 500 msec. and 1000 msec. prior to the CS onset, the inhibitory effect of the RS was certainly found in a few conditioning trials. However, when the duration of the RS was 200 msec., the inhibitory effect was not found until about 30 conditioning trials. And the RS effect differed from the ISI effect even in the condition of the shorter RS.

Several investigators reported that the inferior performance was typically found in the subjects (*Ss*) given a ready signal (RS) before each trial in the eyelid conditioning (Dufort & Kimble, 1958; McAllister & McAllister, 1960a, b; Price, Vandament & Abbott, 1964; Dufort & Rollins, 1965; Turner, 1966; Kimble, 1971). In those studies, the RS-CS interval changed mostly from 1.0 to 4.0 sec. at random. But even when the RS was presented constantly 1.0 sec. prior to the CS onset, the inhibitory effect of the RS was found (Oyamada, 1976). Beyond this fact, little is known about the effect of the RS and no generally accepted theoretical interpretation exists at the present day except Kimble's cognitive inhibition hypothesis.

The purposes of the present experiment were to investigate the following two problems in the condition that the RS was constantly presented a certain time prior to the CS onset: (a) the effect of the RS duration (200, 500 and 1000 msec.), (b) whether the RS effect was the lengthening effect of the CS duration or not, because the *Ss* might accept the RS as one of the successive compounds CS prior to the UCS.

### METHOD

*Subjects and design:* At the beginning of the semester, all students studying introductory psychology at Gifu University and two Women's Junior Colleges were given the Maudsley Personality Inventory (MPI) under the guise of a "reliability" study. Ninetytwo female undergraduates were selected by four criteria of the MPI scales, and requested to serve later as the subjects (*Ss*) in an experiment. The criterion-scores of the MPI were as follows: 16-36 on E scale, 15-34 on N scale, at and below 20 on L scale and ?. The *Ss* had little knowledge of the eyelid conditioning.

When those *Ss* came to the laboratory, they were told that they had been selected from the class rolls "at random". Those *Ss* were assigned serially to one of five groups: one group (Group NRS) was given 60 conditioning trials with no RS, three groups (Group RS 200, RS 500 and RS 1000) with RS, and one group (Group CS 750) with no RS and the lengthening CS. However, seventeen *Ss* were discarded for various reasons; for violating instructions, because the records were defective, because of voluntary responders and because apparatus was not in order. Consequently each group consisted of 15 female undergraduates (mean age: 19.2). The mean score of E scale and N scale of the MPI in the five groups were as follows: Group NRS, 25.5, 24.5 respectively; Group RS200, 26.8, 25.0; Group RS500, 25.8, 24.0; Group RS1000, 26.7, 23.4; Group CS750, 25.4, 22.7. There were no significant differences among five groups.

*Apparatus and procedures:* The CS was the onset of a circular light, 3.5 cm in diameter, 50 cm in front of the *Ss*. The CS intensity was the brightness which did not cause the eyeblinking by the light onset alone. And as a point of the regard, a luminous diode (4.0 v, 35 mA) was placed in the center of the milk-glass disc. The UCS was an air-puff, delivered to the cornea of the right eye through a nozzle 1.0 mm in diameter. An air-puff nozzle was attached to one arm of the face fixed apparatus (T.K.K. universal type). The UCS intensity was approximately 2.25 g/cm<sup>2</sup> at a distance of 2.0 cm from the nozzle. The RS was the onset of a luminous diode used as a point of the regard. The CR recording system, the stimulus control apparatus and the other procedures were the same with those which had been described previously (Oyamada, 1976).

Group NRS underwent 60 conditioning trials in the following procedures: the CS duration was 550 msec., the UCS duration was 50 msec. and the UCS was overlapped in the end of the CS duration. Consequently the ISI was 500 msec. The three groups with the RS, that is, Group RS200, Group RS500 and Group RS1000, underwent also 60 conditioning trials in the same procedures with that of Group NRS except that as the procedure the RS was presented constantly prior to the administration of the CS. The duration of the RS was 200 msec. on Group RS200, 500 msec. on Group RS500 and 1000 msec. on Group RS1000. Group CS750 took 60 conditioning trials in the same procedures with those of Group NRS except that as the procedure the CS duration was 750 msec. The intertrial intervals (ITI) were 10, 15 and 20 sec. and 20 trials in each ITI were arranged at random.

The *Ss* of the five groups were told before the beginning of the conditioning, "Make yourselves comfortable, and adopt a passive and indifferent attitude toward the experiment. Watch a spot in the center of the milk-glass panell, without making effort to do a thing. Don't close your eyes voluntarily, and if you feel like closing your eyes, never prevent it".

Before the conditioning trial, the spontaneous blinkings of the *Ss* were recorded for 2 or 3 min. Next, the *Ss* underwent respectively 2 test trials with the RS or the CS

alone. And two UCS were given to the *Ss* without the CS to record the UCR. In the human eyelid conditioning, the *Ss* became aware of the presentation order of the stimuli in a very few conditioning trials. Therefore, in the present study, the order of the stimuli was previously told to the *Ss* of the five groups; a small red spot-light, a white circular light and an air-puff on Group RS200, RS500 and RS1000; a white circular light and an air-puff on Group NRS and Group CS 750.

A CR was defined as a deflection of 1.0 mm of the recording pen between 250 and 500 msec. in Group NRS, Group RS200, RS500 and RS1000, between 250 and 700 msec. in Group CS750 after the CS onset. And a response that had evidently one of the spontaneous and the voluntary blinking's features was not scored as a CR.

## RESULTS

Fig. 1 presents the percentages of the CRs for all groups in the blocks of 10 trials. The acquisition curves of Group RS500 and Group RS1000 were significantly lower than those of Group NRS ( $F=11.03$ ,  $df=1/28$ ,  $p<.01$ ;  $F=21.03$ ,  $df=1/28$ ,  $p<.01$ ). But between Group RS200 and Group NRS, there was not a significant difference on the mean percentage of CRs through all blocks of 10 trials. However, on the last three blocks (4,5,6) of the conditioning trials, the analyses of the variance yielded satisfactory levels of the significance between Group RS200 and Group NRS ( $F=13.42$ ,  $df=1/28$ ,  $p<.01$ ). And the acquisition curve of Group RS200 was significantly higher than that of Group RS500 and Group RS1000 ( $F=5.24$ ,  $df=1/28$ ,  $P<.05$ ;  $F=59.46$ ,  $df=1/28$ ,  $p<.01$ ). But there was no significant difference between Group RS500 and Group RS1000.

It was considered that the three acquisition curves of the groups with the RS ran mostly in parallel with each other. And those results suggested that the inhibitory effect of the RS varied with the preceding time of the RS from the first block

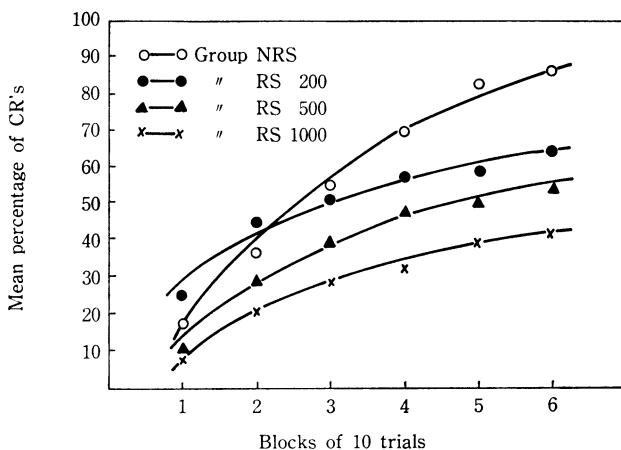


Fig. 1 Mean percentage of CR's for three groups with RS and a group without RS.

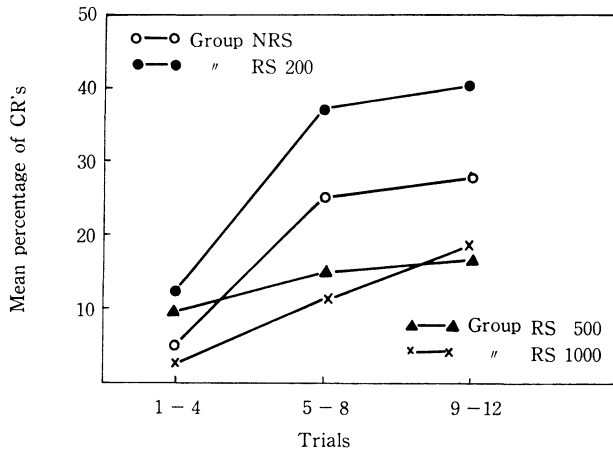


Fig. 2 Mean percentage of CR's for three groups with RS and a group without RS on Trial 1-12.

of the conditioning trials. Then, the results were closely examined on the first twelve conditioning trials. Fig. 2 presents the percentages of the CRs for the four groups in the three blocks of the four trials.

Concerning the mean percentage of the CRs, there was a significant difference between Group RS200 and Group RS500, and between Group RS200 and Group RS 1000 through the three blocks ( $F=12.82$ ,  $df=1/28$ ,  $p<.01$ ;  $F=13.45$ ,  $df=1/28$ ,  $p<.01$ ). But no significant difference was found between Group RS500 and Group RS1000. Those results agreed with those which were found as to the three acquisition curves of 60 conditioning trials for three groups with the RS. However, there was no significant difference between Group NRS and any group with the RS.

Lastly, on the results of Group RS200 which the RS was presented constantly 200 msec. prior to the CS onset, it was investigated, whether the RS effect was a lengthening

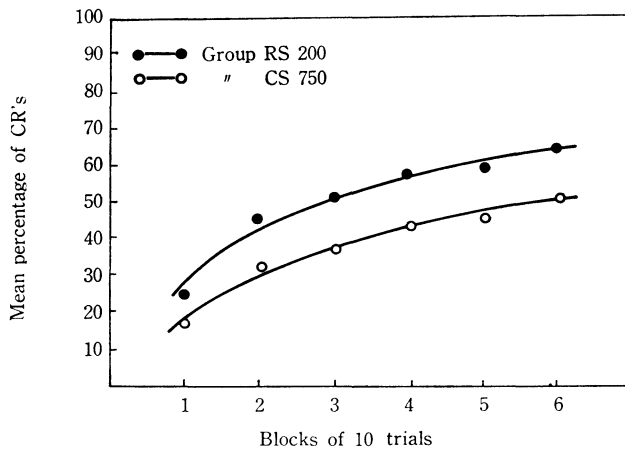


Fig. 3 Mean percentage of CR's for a group with RS and a group without RS.

effect of the CS duration or not. As shown in Fig. 3, the acquisition curve of Group RS 200 was significantly higher than that of Group CS 750 for which the CS duration was 750 msec. ( $F=7.71$ ,  $df=1/28$ ,  $p<.01$ ). Consequently, it was considered that the presentation of the RS 200 msec. was not identical with the 200 msec. lengthening of the CS duration.

#### DISCUSSION

The previous studies obtained the inhibitory effect of the RS under the condition which the RS-CS interval changed generally from 1.0 to 4.0 sec. at random. According to the results of the present study, even though the RS was presented constantly 500 msec. or 1000 msec. prior to the CS onset, the inhibitory effect of the RS was certainly found in a few conditioning trials. However, when the duration of the RS was 200 msec., the inhibitory effect was not observed until about 30 conditioning trials. Consequently, it was considered that the inhibitory effect of the RS varied with the preceding time of the RS.

If a stimulus is presented constantly prior to the CS onset and is not accompanied by the reinforcement, the *Ss* will certainly receive the stimulus as a ready signal (RS) of the CS. In the classical conditioning, it is generally recognized that the several inhibitions are formed by the repeated presentation of the stimulus with no reinforcement. Then, it is necessary to examine whether the inhibitory effect of the RS can be explained or not by the those inhibition hypotheses, that is, conditioned inhibition, differential inhibition and external inhibition (Pavlov, 1928), and primary inhibition (Konorski, 1967, 1972). The problem was discussed in the author's other paper mainly on the presentation procedures and the strength of the stimulus without reinforcement (Oyamada, 1977). And there were some difficulties in explaining the inhibitory effect of the RS in the eyelid conditioning by those inhibition hypotheses.

Kimble (1971) proposed a hypothesis, that is, the cognitive inhibition hypothesis. Kimble's hypothesis has its origin in Sechnov's (1935) general proposition that the preparedness interferes with reflex behavior. In an unpublished eyelid conditioning experiment by Pelmer, Krens and Kimble, when the *Ss* were conditioned with the three different types of the RS, that is, the word "ready", a white noise and an air-puff, Kimble et al. found that the greatest amount of the inhibition occurred in the group with the verbal RS. And Kimble asserted that those results were "one of the strongest pieces of evidence for the validity of Sechnov's general proposition", because "to the extent cognitive processes are verbal processes", and he asserted, "this supplies support for the hypothesis that ready signals have their effects through a mechanism specifically involving cognition".

Kimble's hypothesis is a most interesting hypothesis. And some results in the present experiment were explained by his hypothesis. However, Kimble didn't refer to the differences between the cognitive inhibition hypothesis and the other inhibition hypothesis in the classical conditioning. Moreover, if the inhibitory effect of the

RS was produced by the cognitive inhibition, what was the cognitive inhibition formed rapidly in the 500 msec. and 1000 msec. conditions of the RS and on the contrary slowly in the 200 msec. condition of the RS? Therefore, it was considered that one of the problems to explore was the process of producing the cognitive inhibition or the inhibitory effect of the RS.

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(Received October 10, 1977)