Studies on Sensory Overload: IV Part 4. General Survey

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PART 4. GENERAL SURVEY

By

SEIRO KITAMURA (北村晴朗),

(*Department of Educational Psychology, Akita University, Akita*)

TOSHITERU HATAYAMA (畑山俊輝)

(*Tohoku Gakuin University, Sendai*)

and SHUN-ICHI SAITO (斎藤俊一)

(*Tohoku Institute of Technology, Sendai*)

The results of preceding papers on sensory overload were summarized and compared with those obtained by sensory deprivation of confinement hours equal to sensory overload. A certain degree of differential effects of sensory overload and sensory deprivation condition upon human mental functions were clarified. At the same time, the phenomena common between both groups, like the underestimation of confined hours, hallucination-like experiences and affective values of the loaded stimuli, were reported, too.

We have made the experiments on Sensory Deprivation (SD; Perceptual Deprivation in a narrow sense) as a methodology for understanding human behaviors in a normal situation. For the purpose of clarifying further the effects of SD, by setting up the situation where the excessive sensory stimulations over the normal levels of intensity were in action for a given duration (Sensory Overload; SO), we have developed the comparative studies with SD situation.

The experiments on SO in which three or five hour confinements were utilized, were all short-term because long-term overload lasting for more than five hours was considered to be too severe for *S*s to tolerate. Furthermore, in the course of these studies it became clear that there were no essential differences between the three and five hour confinement, so the three hour period was often adopted for experimental convenience.

These experiments, as seen in Table 1, were conducted throughout the periods five times and the data of 57 *S*s obtained. Methodologically SO experiments share common problems such as social isolation and movement restriction with SD, except stimuli loading. From our hypotheses concerning SD effects (Kitamura and Ohkubo, 1960), it was suggested, therefore, that the SO might have unfavorable effects on the various functions of organism, because of overstimulation.

Table 1. Outlines of the experiments on SO.

Exp.	Group	No. of *Ss*	Confined hours	Condition of sensory inputs
I (1967)	SO	18	3	Loaded
II (1968)	SO	11	3	Loaded
	SD	16	3	Deprived
III (1969–1970)	SO	8	5	Loaded
	SD	8	5	Deprived
	Cont.	8	5	Free
IV (1970–1971)	SO	10	3	Loaded
	SD	10	3	Deprived
V (1971)	SO	10	3	Loaded
	SD	10	3	Deprived
	Cont.	10	3	Confined

Our main purpose of SO studies was to compare the results obtained by SO experiments with those from SD employing the same experimental period of time, and to elucidate how SO situation would influence the different functions of organism.

The results of the experiments reported in the preceding papers will be summarized and discussed with reference to those of our previous reports stated in Tohoku Psychologica Folia (1970, 28; 1971, 29; 1971, 30).

I Physiological Effects

1) *EEG changes*

From the data of transitions of each arousal level as reflected in the EEG data (Hatayama, Takayama and Komatsu, 1970; Kitamura, Hatayama and Maruyama, 1971; Hatayama and Komatsu, 1971), it was revealed that almost all the *Ss* of SO group were dominated by the fast wave EEG patterns suggesting alertness throughout the whole course of the confinement, with a few *Ss*, however, showing the EEG patterns involving light sleep ones for a short time. For the group of SD relatively many *Ss* showed slow wave patterns characteristic of light sleep and deep sleep ones, particularly in the first half of the confinement. However, in the SD group there was a tendency toward the gradual increases of the number of *Ss* exhibiting fast wave EEG patterns in the second half of it. Such findings held good with a series of our studies on SO, regardless of isolation duration. The data of the percentages of appearance per each of four EEG patterns, the shifts of the number of body movements and the percent changes of heart rate showed that arousal level was higher in the SO condition than in the SD (Hatayama, et al, 1971).

The results of analyses of average dominant frequencies during the waking and resting states showed a tendency of phasic "slowing" within beta band in the second half of the confinement. But, whether such "slowing" is related either to the change

of arousal level, or to the motivational losses (Zubek, 1969) will require further investigations, since no distinguishable changes have been observed within alpha band.

2) Averaged evoked responses to sensory loaded stimuli

In our experiments on SO, it was considerably difficult to obtain enough data for analysis, because of the presence of artifacts due to *S'* body movements. Evoked responses were therefore examined only as to several cases of relatively artifact-free data. VERs showed the waning of amplitude in a component of evoked responses with peak latencies from 80 to 160 msec subsequent to the 1.5th hour in three hours of SO, to the 2nd hour in five hours of it (Hatayama, et al, 1970; Kitamura, et al, 1971). These phenomena were also seen in the data of AERs reported in the present study. Moreover, from the results obtained this time, it was suggested that the presence of a relatively sound sleep during the confinement might constitute an important factor in occurrence of evoked response. For example, the waxing of amplitude in evoked response was again recognized in the *S* immediately after awakening from sleep.

II Sensory and Perceptual Processes

1) *Measurement of auditory threshold*

A decrease in auditory sensitivity to 1000 Hz tone was seen at the post stage in the SO condition. No significant "pre-post" differences in absolute thresholds were shown in the other frequencies (500, 2000 Hz) used in the present study. In the SD group there were no distinguishable changes in any frequency. These results agreed well with the previous study (Komatsu, Ohta and Kato, 1971). However, the data concerning the increase in threshold in the SO group are inconsistent with those reported by Kikuchi, Kikuchi, Kawaguchi, Hatakeyama and Yoshiizumi (1970), and Takayama and Hatayama (1971). With regard to this question, it must be noted that from the first to the third experiment the 1000 Hz tone and the white noise were loaded simultaneously, whereas in the fourth and the fifth experiment was only used the 1000 Hz tone as the loading stimulus. The fact that while the decrease in sensitivity was reported only in the latter experiments, there were no significant changes in the former, may reveal, therefore, that the white noise had the masking-like effects upon the 1000 Hz tone used simultaneously in the earlier experiments. If so, it may safely be said that the lowering of sensitivity specific to the 1000 Hz tone is the effect of the 1000 Hz tone per se which was given during the confinement. The effect of such a poorer acuity in the SO condition showed the trend toward a progressive decrease during the time course of this test administration. In this respect, SO effects in sensory level did not seem to last long.

2) *CFF*

Changes in CFF were examined by using the improved apparatus of CFF in the present study. In both conditions of SO and SD, the tendency to decrease in CFF

was observed and this was almost the same as ever (Kikuchi, et al, 1970). However, since such a tendency was seen also in Control group in the present study, it seems that no effect on CFF was produced by the confinement condition of SO or SD.

3) *Estimations of stimulus affective values*

For the purpose of continuing the preceding study (Komatsu, et al, 1971), the affective values of loaded stimuli were investigated experimentally. From the data of interview with *S*s, Sato, Murai and Kinebuchi (1970) and Sato, Kinebuchi and Murai (1971) reported that all the *S*s felt the auditory loaded stimuli more discomfortable than the visual throughout the confinement. On the contrary, Komatsu, et al, pointed out that there might be "a kind of avoidance tendency against the visual loaded stimulus" rather than the auditory. The latter result was nearly supported by the present study, too. However, the data for estimations of affective values showed the "aversive responses" to any loaded stimulus in both SO and SD groups, regardless of the difference in sensory modalities overstimulated. It is inferred from this fact, therefore, that the above-mentioned inconsistency of results may also have stemmed from some effect of white noise used in the earlier SO studies.

III Changes in Memory and Learning

No condition of confinement durations resulted in any differences among SO, SD and Control groups as well as within each group on the short-term memory (Saito and Tada, 1971). It was suggested, however, that the increase in the numbers of items to be recalled might produce a deteriorating effect of SO condition. The results of retention tests of an essay and meaningful materials indicated that while there was a tendency toward decrease in the mean amount of retention at post stage for the SD group, there was none for the SO subjects. Moreover, no consistent results were obtained for the continual word association tests, too (Kikuchi, et al, 1970; Saito, et al, 1971). But, the data for association test in the present study showed the increased rate of occurrence of the words assuming a negative affective tone, especially in deprived *S*s. These results showed that SD condition might have more impairing effects on this type of tasks than SO. The tests in rule learning as a sort of insight learning have been made twice in the condition of three-hour confinement, without any consistent result.

The key-tapping tests were applied as one of simple tasks (Saito, et al, 1971; Saito, 1971). In general, key-tapping efficiency seemed to be facilitated by both SO and SD conditions.

In short, it may be said that performance on simple tasks will be either facilitated or unaffected by the confinement conditions such as SO or SD, whereas although there may be a certain degree of deteriorating effect on complex task performances under the SD condition, there appears to be no consistent effect under the SO.

IV Changes in Susceptibility to Influence

The *S*s under the condition of SO felt the confinement severer than the deprived *S*s, regardless of confined hours (Sato, et al, 1970; Shimada, Kawata and Okabe, 1971). This fact is consistent with the preceding results that almost all the *S*s judged the visual and the auditory stimuli loaded during the experimental confinement severe in the test for estimations of stimulus affective values. From the results of other tests for estimations of emotional states, it can also be said that SO is the situation where the *S* perceives as discomfortable in comparison with a normal situation.

So far, it seemed interesting that in the data of interview was seen a relatively rapid return to the normal preconfinement states of emotion after release. However, the association test performed using a sort of projective technique in the present study revealed that negative affective tone would remain in action through post stage. This suggests a lasting effect of confinement upon emotion.

Besides these results, it is notable that hallucination-like experiences seen in SD condition were also reported in a few *S*s of SO.

In order to investigate time estimation, each *S* was asked to estimate how much time passed during the experimental confinement. The data on SD thus far reported showed a tendency to underestimate the confined hours. Furthermore, this finding was similar to one obtained from both SO and Control condition. It is clear, thus, that underestimation of time found out in SD studies is not the effect of SD, but of confinement itself.

Discussion

From the findings stated above, it appears we are able to point out a certain degree of differential effects of SO and SD condition upon human mental functions. First, considering the above-mentioned data in connection with those of the tests for two-point limen and dot detection time, mental functions on sensory level seem to be slightly facilitated by confinement, with relatively deep effects of SD. In the SO group it should be noted that the decrease in auditory sensitivity specific to the loading stimulus was seen in the post session and no effect was produced on CFF. These phenomena seem to permit us to interpret the gradual waning of amplitude of VER or AER during the confinement as those related to "sensory habituation" or "adaptation". Secondly, the data of the transition of arousal level suggested the high arousal level during the confinement in the SO subjects, and the initial effect of adaptation seen in relatively many SD subjects, followed by the tendency toward enhancement of arousal level in the second half of the confinement in deprived *S*s. From the data of the other polygraph records, it was inferred that arousal level was higher in the SO condition than in the SD. Therefore, although there may be a somewhat enhanced level of arousal in the second half of the confinement under the SD condition, it seems to be justifiable to say that arousal level is generally higher in the

SO condition than in the SD. In addition to these findings, some of the stressful subjective responses to the loaded stimuli were observed in both groups.

If such changes are undoubtedly caused as the effects of SO or SD itself, these facts will reasonably be explained from the hypotheses such as Optimal Level of Stimulation (Zuckerman, 1969), or Sensoristasis (Schultz, 1965). However, in spite of the existence of various loading effects upon physiological, sensory functions and primary process thinking in the SO group, we remain to be unable to recognize no marked changes in the higher mental functioning inferred from the results of the tests on memory and learning. Here it was suggested that various effects would be produced on the relatively basic processes by the SO condition without any remarkable change in the higher mental processes. Furthermore, as inferred from the habituation-like phenomena under the SO situation, the *S* appears to make some positive attempt to adapt himself even to such a situation. Therefore, although individual basic functions are influenced variously by the SO condition, the controlling processes, to some degree, go on smoothly so that the organism's behaviors as a whole would be organized integratively.

These findings seem to make a full explanation of SO effects from the above-stated hypotheses difficult. However, this question should be held in abeyance until the mechanisms underlying the effects on the higher functioning are further clarified, since we can not exclude a possibility that they are produced as a function of confinement hours.

The experimental procedures which compared the results obtained by SO experiments with those from SD or Control using the same experimental period of time seemed to have made clear not only the differentiating effects of stimuli loading from reduced stimuli, but the effects caused by the conditions of the confinement itself common to both experiments. For example, the phenomena such as hallucination-like experiences and underestimation of confinement hours etc., which had been considered to be characteristic of SD condition, have been seen also under the SO condition. The data from the various kinds of confinement experiments, therefore, should be examined not individually, but collectively.

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