A Short Critique of “Single Case Experimental Designs” or
a Proposal of Observational Analysis of Behavior

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INTRODUCTION

More than two decades have passed since Hersen and Barlow (1976) introduced what is called “Single Case Experimental Designs (SCED hereafter)” to the area of Behavior Analysis (BA). The concept of the SCED seemed to have accepted widely in the area of Experimental Analysis of Behavior (EAB). Especially, in the field related to the behavior modification of children with handicaps, almost all the studies have adopted “AB designs” or “multiple-baseline designs.”

Although almost all the researchers of EAB agree that the SCED is a very powerful device to make clear whether a certain method of intervention is effective to a subject like child with a handicap, some problems have been pointed out from a theoretical point of view (Kazdin, 1979; Birmbrayer, 1981; Baer et al., 1987; Holcombe, et al., 1994). Clearly there are some “threats” not only to internal validity of the theory but to the determination of effectiveness of some interventions. For instance the factor of “History” is as follows: “Any event (other than the intervention) occurring at the time of the experiment that could influence the results or account for the pattern of data otherwise attributed to the intervention” (Kazdin, 1982). In other words, subject’s behavior could be changed by some events that could happen between two experimental sessions: there might be some events that researchers could never know. One more example is “Testing,” which is described as follows: “Testing constitutes an experience that, depending on the measure, may lead to systematic changes in performance” (Kazdin, 1982).

MODIFIED DESIGNS

As we described above, multiple baseline design across subjects is one of the effective designs for EAB and applied behavior analysis. However, the design cannot control almost all the threats including historical events, testing, and maturation. The events that occur in the daily life (i.e. the “History”) could be different for each subject. The sensitivity for the “Testing” could be different among subjects. It is possible for subjects to have different pace of “Maturation.”

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Fig. 1 Hypothetical data for a traditional AB design.

Fig. 2 Hypothetical data for a modified AB design.
We believe, however, that some of the threats, especially for historical events, can be avoidable. Fujikane (1998) introduced an intervention during the very last session of obtaining baseline, in order to avoid the "History" factor affecting subject's behavior (modified AB design). He succeeded in finding out the increase of the frequency of some behavior in one session i.e. at the first part of that session he obtained the baseline, and afterward he started training in the same day (Figs. 1, 2). In this way the researcher could safely conclude that there is a certain effect of training without any influence of "History," at least between the last part of baseline and the first part of intervention.

However, some of the threats are inevitable. The researchers should carry out probing tests in order to determine the level of baseline and to measure the effect of intervention. It is possible that any kind of tests cause systematic changes in performance. For instance, when carrying out an experiment on "memory" of human beings, any kind of "rehearsal" must affect the results. In an essential meaning of "Testing," an experimenter should provide some stimuli used in the experiment. The testing itself clearly prompts subjects to rehearse the material. In addition, coming to think of usual classes in schools, one of the purposes to assign students some tests is to let them remember what they were taught and enhance their knowledge.

The researchers should notice that some threats could not be controlled even if s/he adopts the experimental designs such as multiple-baseline designs and/or modified ABA designs.

ETHICAL ISSUES

On the other hand, it is well-known that there are many ethical arguments on the experimental area related to human beings i.e. Psychology, Education, etc. Especially, in the field related to the handicapped, the situation is quite serious. It is the first one to be spelled out as an example.

A researcher must adopt AB designs or multiple-baseline designs if s/he believes a certain program of intervention is effective for modifying behaviors of a certain type of children with handicaps, trying to demonstrate it. If s/he decides to use AB designs, s/he should stop applying the program which produces excellent results at least for a while. The effect of the discontinuation is totally unpredictable: the child might get worse than before. At least it is possible that the program turns out to be not so effective as before. Of course a researcher could apply multiple-baseline designs in order to demonstrate the effectiveness of the program. Suppose s/he adopts "across subjects" design, s/he should carry out the program to one subject, while s/he looks on with folded arms to another subject. Sometimes the non-training period for one child lasts 2 to 3 months until the effect of intervention for the other child appears to be clear. At least as far as the parents of children with handicaps are concerned, it is much unsatisfactory or even irritating to see some other children are improving much while their children are left alone.

We do not assert that the "demonstration" of the effectiveness of a certain program is nonsense. Rather, we fully understand the importance of demonstration, because we cannot be sure to apply a program to certain children without such kind of demonstration. However, it is still clear
that there are some ethical problems in SCED itself.

**ESSENTIAL LIMIT OF EAB**

We have believed that there is a theoretical limit on EAB. Basically the method of demonstration of EAB is to grasp the change of some behavior by certain operations, like providing reinforcement, punishment, etc. However, some behaviors cannot be changed by those operations. In this article, we use the word "innate," which is slightly outdated, to describe some kinds of genetically inherited behavior. "Innate" means "ontogenetically developed without any shaping influence from the environment or experience" (Immelman et al., 1989). In other words, anyone cannot change the innate component of some behaviors by controlling environment.

Let us have a brief look at an example. All the children, without exception, start producing what is called "cooing" sound when they come to 1 to 2 months old. Even children with profound hearing impairment or children with serious mental retardation utter cooing at the very first of their development. Although cooing disappears for some children with handicaps afterward, all the children who do not have disorders with their sound producing organs produce cooing. This fact suggests that the cooing is innate behavior, at least at the very beginning of its history. No one can control the emergence of cooing at the first stage.

Now a question arises: can a researcher in the field of pre-linguistic development use EAB technique to clarify the functions of early vocalizations of babies? The answer is clearly "No." Since it is supposed that the earliest vocalizations of babies are innate, the method of EAB is useless.

The alternative method of research could be the "introspective method." However, researchers cannot adopt this method to figure out the functions of early vocalizations, because they do not have any "topography" which suggests the functions. It is the field in which we should try to apply the methodology, or at least the framework, of Behavior Analysis most.

**OBSERVATIONAL ANALYSIS OF BEHAVIOR**

We believe that the ultimate goal of Behavior Analysis is to analyze and to clarify functions of behaviors in the framework of "three-term contingency."

\[\text{Antecedent phenomena} \rightarrow \text{Response} \rightarrow \text{Following phenomena}\]

(\text{Discriminative stimulus, Deprivation, Establishing operation, Setting event etc.})

(Any environmental changes including Reinforcement, Punishment, etc.)

What we should know is "antecedent phenomena" which exist before a certain behavior, and
"following phenomena" which occur after the behavior. We do not think the following phenomena necessarily change the frequency or some other components of behavior. One of our assertions is that some behaviors change environment but are not to be necessarily changed by environment.

There are several methods of figuring out antecedent phenomena and following phenomena from observations. For instance, in order to clarify whether a behavior is controlled by deprivation, we should observe whether the tendency of occurrence of the behavior increases after that behavior occurred last, i.e. if the probability of occurrence of the behavior increases under the flow of time. Actually, Hayashibe et al. (1996) argued that the early crying of babies has the similar function as MAND, utilizing the method of IRI analysis.

Another method of figuring out a contingency is to observe what happens immediately after a certain response directly. If a mother speaks to her baby immediately after his/her non-crying vocalization, this might have a function of causing the mother's talk. In this case, demonstrating whether the phenomenon (e.g. mother's talk to the baby) is truly contingent upon the response (e.g. baby's utterance) is not so easy. It is possible that a mother speaks to her baby not only immediately after baby's utterance, but just randomly. As for this issue, some statistical devices which are applicable for solving the problems have been developed recently (e.g. Bakeman, et al., 1997). At least in some situations, we can figure out what is truly contingent upon some events. Although the reliability of the results from those kinds of treatment is still somewhat limited compared to the experimental methods, considering the limitations of EAB mentioned above, the "Observational Analysis of Behavior (OAB)" should be taken into account as an option to clarify the function of behaviors.

In addition, it is clear that we can overcome the ethical problems, at least in terms of fairness, in a study utilizing the method of OAB. We do not need to treat two or more subjects differently, nor to stop training in order to figure out the contingency. On top of that, we can figure out the contingency in a daily situation, which is quite difficult for EAB.

The essential advantage of OAB is that a researcher could clarify the functions of innate behaviors. As we noted above, it is virtually impossible to study innate behavior with EAB. When we utilize the OAB method, it is considerably simple to figure out the function of a behavior that is assumed to be innate. EAB is not suitable for clarifying the functions of the very first vocalizations of infants.

We assert neither that EAB is totally useless nor that OAB is perfect in order to figure out the contingencies of behavior. Although the method of OAB is still very limited, we should value it and try to develop more sophisticated methods or technologies in the OAB from now on. Eventually, EAB and OAB should supplement each other to construct the general theory of behavior analysis.

SUMMARY

The method of EAB is considerably limited in a theoretical sense and has ethical problems. Especially, EAB cannot deal with the issues related to the innate behaviors, which are not affected
by environmental control.

Although the method, which enables a researcher to figure out the contingencies of behavior from observation, still has many problems including the reliability of data processing, it can clear the problems mentioned above. We believe that the OAB is a method of analyzing the behavior in terms of three-term contingency.

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