LEARNING, NEUROSIS AND STUTTERING

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Learning

The field of learning has attracted considerable professional attention in **the** recent past. This is due to the fact that 'laws of learning' have found wide application in the field of education and in the explanation and successful treatment of neurosis as learned behaviour. The article intends to set forth the basic processes of Pavlovian and Skinnerian learning and to point out why and how neurotic behaviour can be considered a learned behaviour. The concluding part of the article relates to a brief consideration of stuttering as a maladaptive learned response.

The term learning is used with a broader sense by learning psychologists than it is commonly done. In psychological usage what is learned need not be 'correct' from the evaluative point of view; an adaptive behaviour need not be deliberate, and need not necessarily involve an overt act. As such a wide range of human behaviour comes under the purview of the field of learning, no hard and fast definition of the concept of learning is as yet possible. But psychologists are agreed upon certain definable aspects of learning. They are:

(r) Learning is a process that results in change of behaviour.

(2) The change of behaviour is a result of practice or experience and not due to temporary physiological states or due to biological development.

(3) A learned response is not transitory. However, what has been learned can be unlearned.

(4) It is infered; what is observed in the laboratory is change of performance and not learning. Performance of an animal is a function of a host of variables like age of the animal, health, motivation etc., in addition to learning.

The earliest experimental study of what has been later considered learning was done by Ivan Pavlov, a Russian Physiologist. While conducting experiments on alimentary secretions he noticed that the dog (the experimental animal) salivated at the sight of the attendant who brought its food daily. (Usually salivation occurs when some edible substance is placed in the mouth). This led Pavlov to conduct a series of experiments that are now considered to be the classical studies on learning, which resulted in the discovery of processes like generalization,

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discrimination, and higher-order conditioning. These laid a solid foundation for the contiguity theory of learning, even though Pavlov maintained that his contribution was chiefly to the field of physiology, in particular to the area of higher neural activities. Time showed, however, that his contribution was more significant to psychology, rather than to physiology; for physiologists today are hardly ever concerned with the techniques and constructs developed by him.

The key concepts in Pavlovian Paradigm are unconditioned stimulus (UCS), unconditioned response (UCR), conditioned stimulus (CS), conditioned response (CR) and reinforcement (R).

A stimulus which has the property of eliciting a natural, inborn response (UCR) is called an unconditioned stimulus. Thus the UCS may be food in which case the UCR is salivation.

There are many such stimulus-response connections in the human behavioural repertoire. The eye-blink (UCR) in response to a puff of air (UCS), finger withdrawal (UCR) to electric shock (UCS) are other examples.

Any stimulus which acquires the property of eliciting a response which originally it did not elicit is called a conditioned stimulus. The response given to CS is called a conditioned response (CR). Thus if a tone precedes the presentation of food several times by 5 seconds, the experimental subject will salivate to the tone alone after a while. The tone in question is CS and the salivation, CR.

Reinforcement (R) refers to the repeated pairings of CS and UCS which results in the strengthening the CS-CR bond. Thus, operationally, conditioned response (salivation) is more (in terms of quantity of salivation) if the pairing of CS and UCS is done I00 times rather than 50 times.

The above conditioning procedure can be illustrated by the following Scheme:

Before the Experiment:	Food (UCS)		Salivation (UCR)
	Tone (CS)	Pricking	of ears (UCR)
After the experiment: (after several pairing of UCS and CS).			
	Food		Salivation
	Tone (CS)		Salivation (CR)

Thus we see the tone for which the dog was indifferent or showed some random response, has gained the power to elicit salivation, thus resulting in change of behaviour. This change of behaviour to tone was noticed after practice. Thus conditioning is a learning phenomenon.

Ordinarily UCS occurs either at the same time as, or just after the onset of, the CS; the conditioning with this type of UCS-CS temporal relationship is called

simultaneous conditioning. But beyond this all possible temporal relationships have been used in conditioning research. They are as follows:

Backward conditioning: Here CS-UCS relationship is on the negative side; in other words, UCS preceeds CS at the onset and ends before CS. The conditioning if at all, occurs slowly, the strength of which depends inversely on the interval between the CS-UCS.

Trace conditioning: Here the CS preceeds the UCS in time at the onset and it ends before UCS begins. The rate of conditioning is slower than in simultaneous conditioning. 'Any convenient external stimulus is applied to the animal and continued for ½ to I minute. After a definite interval of I-3 minutes, food is introduced into the mouth. It is found that after several repetitions of the routine, the stimulus by itself will not evoke any reaction; neither will its disappearance; but the appropriate reaction will occur after a definite interval, the after-effect of the excitation caused by the stimulus being the operative factor'. (Pavlov, 1665, p. 14).

Trace reflexes differ in character according to the length of the pause between the termination of the conditioned stimulus and the appearance of the unconditioned stimulus. When the pause is short, being a matter of only a few seconds, then the trace—afferent state—of the conditioned stimulus is still fresh, and the reflex is what may be termed short-trace reflex. On the other hand, if a considerable interval—one minute or more—is allowed to elapse between the termination of the conditioned stimulus and the beginning of unconditioned stimulus, we have a long-trace reflex.

It is important to note that not only the interval between the termination of the CS and the beginning of the UCS is of importance but also the level at which the animal is on the evolutionary scale—the higher the level the greater the facility with which long-term trace reflexes are formed.

Delayed conditioning: In this type of conditioning, there is considerable delay between the onset of the CS and the UCS, the CS preceding the UCS, termination of both the stimuli occurring at the same time. Conditioning proceeds slowly and the conditioned response occurs on the presentation of CS after the same delay as was used in conditioning trials.

Before leaving the area of UCS-CS temporal relationships it should be noted that undue emphasis has been placed on simultaneous conditioning to the exclusion of other temporal relationships. This is partly due to the fact that this relationship has been used in experiments more often than others because conditioning occurs relatively easily with this procedure. Naturally one is led, while analyzing a learned behaviour, to consider this temporal relationship and often finds himself unable to place CS and UCS in what appears to him the only proper temporal relationship. This aspect has to be emphasized from other important points of view. Human beings are known for their superior learning ability when compared

to the animals. Therefore, what appears to be an ineffective CS-UCS temporal relationship in lower organisms may be effective in human learning situations.

Generalization of conditioned response: When a subject is trained to give a CR to a CS, he has really been trained to give the CR to a group of other stimuli with which the CS forms a class. All the stimuli within the class bear either physical or learned similarity. This tendency on the part of those stimuli that have not been used in the original conditioning situation to elicit the CR is called generalization. When generalization takes place on the basis of physical similarity between stimuli, it is called primary generalization. If it takes place on the basis of learned similarity, it is called secondary.

Thus a subject who has learned to respond to 1000 cps tone with salivation, will salivate to tones 500, 600, 700, cps etc., at one end of the physical dimension (frequency) and to the tones 1100,1200,1300 etc., at the other end of the same dimension. This is an instance of primary generalization. When conditioned response to the stimulus 'child' is generalized to the word 'infant' there occurs secondary generalization. Secondary generalization is distinctly human, widely occurring in his semantic world.

Another concept encountered with relation to generalization is the generalization gradient. It refers to the fact that a generalized response is not of the same strength as to that of the original CS. Generalization decreases or increases as a function of physical or learned similarity between a particular stimulus.

The phenomenon of generalization is present to a large extent in the human world—human beings apparently 'seek' to generalize by discovering hidden likenesses in what may seem to be unrelated phenomena. The creative activity of the scientific world is based on inductive reasoning (discovery of unity among several phenomena, sometimes apparently unrelated phenomena, in the shape of laws and still further, theories) which is in reality generalization.

Discrimination: Discrimination is a process wherein the CR is prevented from being generalized to a stimulus in the class to which CS belongs. This is brought about by differential inhibition of generalized response to stimulus in question. Thus when a subject is trained to salivate to 1000 cps tone, it will be generalized to 500 cps, 600 cps, 700 cps, etc. If the experimenter decides that the animal should not salivate to 900 cps he differentially inhibits generalized response to this tone by presenting 900 cps and 1000 cps one after another and by reinforcing only 1000 cps. This process establishes discrimination between 900 cps and 1000 cps. The result is that the animal will salivate to 1000 cps but will not do so for 900 cps.

Thus, discrimination and generalization are two processes opposed to each other the former involving reduction of unity into multiplicity, the latter, reduction of multiplicity into unity. Both generalization and discrimination may be at the base of many pathological behaviour showed by individuals.

Extinction: On repeated presentation of CS without UCS the CR-CS bond is weakened and finally the subject stops giving CR to CS; or the original CR is apparently no longer a CR. This process of eliminating the CR is called extinction. Thus if an experimenter goes on presenting 1000 cps without at least occasionally reinforcing it with food, the animal stops salivating to that sound.

If a novel stimulus is introduced while an experimenter is attempting to extinguish a CR, a temporary increase in the strength of the faltering CR occurs. Pavlov called this the inhibition of inhibition or disinhibition the mechanism of which is beyond the scope of the present paper. Another interesting and crucial phenomenon connected with extinction is spontaneous recovery. This is a phenomenon of occurrence of CR on the presentation of CS, following a period of rest after extinction trials. But the recovered response will not be of the same strength as that of the former CR. If the animal is put into a series of extinction—rest—elicitation cycle, the CS eventually stops eliciting CR. Pavlov further noted that there is not only partial or complete extinction of the conditioned response, but that extinction can proceed beyond the point of reducing a conditioned reflex to zero, if the extinguished stimulus is presented still further. This 'extinction below zero' deepens proportionately to the presentation of former CS after complete extinction has been achieved. The concept of extinction below zero has important bearing upon unlearning of responses because the reconditioning of the stimulus as a CS becomes rather difficult. This is so because the stimulus will have acquired properties of an inhibitor.

Higher Order Conditioning: It is the conditioning of a response to a stimulus using a conditioned stimulus to elicit it. Thus a subject who has learnt to salivate to a tone, can be made to respond to a flash of light by repeated presentation of the tone and flash of light, the latter preceding the former. This is the first level of higher-order conditioning. Pavlov was not able to go beyond the second level of higher order conditioning in case of dogs. But in human beings many higher-orders of conditioning have been achieved; this is especially so in learning of languages. Thus a child learns to give an emotional response to the word 'bad' because he is generally punished after some act of his has been labelled 'bad'. In this case the word 'bad' is the CS, punishment is the UCS, and some emotional response such as feeling unpleasant is the UCR. After a number of pairings of 'bad' with punishment, the word bad itself will begin to arouse conditioned unpleasant feelings in the absence of physical punishment. Now if the child is told that 'dirt is bad' the word 'dirt' takes some of the unpleasant feelings of the word 'bad'. This is a case of first higher-order conditioning; this can be multiplied several times. Basing their argument on this process, some psychologists hold that all learned behaviour, however complex, is analizable into series of conditioned responses established through higher-order conditioning.

The importance of conditioned stimuli for adaptive behaviour or their survival value has been stressed by Pavlov and his school. The importance of conditioned

responses as adaptive behaviour is well illustrated in the behaviour of a dog which has been decorticated and which cannot form conditioned responses. It does not behave normally by salivating at the sight of food—CS for food—and at the sight of a stick—CS for defensive behaviour by barking and running away. Such a decorticated dog will have difficulty in adapting to its surroundings as the sight of food and sight of a stick do not have signalling-value. This led Pavlov and his followers to stress the 'signalling nature' of conditioned stimuli. As Pavlov notes lucidly in one of his lectures, 'It is pretty evident that under natural condition the normal animal must respond not only to stimuli which themselves bring, immediate benefit or harm, but also to other physical or chemical agencies—waves of sound, light and the like—which in themselves only signal the approach of these stimuli though it is not the sight and sound of the beast of prey which is in itself harmful to the smaller animal, but its teeth and claws'. (Pavlov, 1960, p. 39). Man's adaptive behaviour has been further enhanced by his development of a 'second signalling system', or language.

It is a paradox that man's conditionability, though it has increased his adaptiveness, has at the same time increased his susceptibility to learn those behaviours which are maladaptive. What is referred to here is neurotic behaviour, which will be shown to be due to learning after a brief presentation of another learning paradigm, namely Skinnerian, which is also relevant for an understanding of neuroses.

Operant Conditioning

It is the opinion of many psychologists that the basis for all learning is classical conditioning. But many others take the view that there exists at least one more type of learning based on operant conditioning discovered by Skinner.

The following are the essential features of the operant paradigm: Subjects operate on the environment by emitting a response. Depending on the nature of the consequence or the net effect of consequences, the probability of occurrence of that response either increases in which case the consequences or net effect of consequences constitute positive reinforcers or, decreases—in which case the consequence or net effect of consequences constitute negative reinforcers. Thus the term reinforcement as used in operant paradigm is different from that in classical conditioning. Here lies the chief distinguishing feature between classical and operant paradigm. In the former, learning depends on contiguity, say, pairing of tone and food; in the latter, on contingency—what follows as a consequence of the emitted behaviour.

The most well-known apparatus used for operant conditioning is a small, sound proof box containing a little lever, food cup and a light. This apparatus is called a 'Skinner box'. A hungry pigeon is placed within the box, the animal starts moving about randomly and pecking at the various objects in the cage. Accidentally when it chances upon the lever it is reinforced for the act of lever pressing by dropping a pellet of food into the food cup. Right at the first instance

the animal does not learn that 'lever-pressing produces food'. After many such accidents the animal learns that lever-pressing produces food. From this the **act** of pressing the lever increases in frequency.

In the above example the animal is reinforced for every lever pressing response. Hence the acquisition is fast. On the other hand if the animal is reinforced not every time but only after say two responses, or for response occurring at the end of every one minute, then the acquisition will be slow.

The basic process of discrimination, generalization and extinction is seen in operant paradigm also. The animal can be made to press the lever only when a red light is flashed by rewarding it, thus make the flash of red light a discriminatory stimulus. Based on physical similarity the operant response of pressing the lever is generalized to other stimuli in the class to which the red light belongs. Interestingly, it has been found that pigeons conditioned to particular colour say red, also respond to other colours in the spectrum, though the strength of the response depends on the nearness of the colour to the conditioned red—the nearer the colour the greater the strength of generalized response. Thus orange and yellow elicit responses which are stronger than green and blue—the generalization gradient proceeding quite regularly along the dimension of wave length.

Extinction of operant responses occurs following the withdrawal of the reinforcer. When the animal is stopped being reinforced the response starts to be extinguished. The extinguished responses do show spontaneous recovery when the animal is placed in the same situation again, but eventually, after facing the situation several times, the response is completely extinguished. Extinction of responses learnt on one response-one reinforcement schedule is faster than that of responses learnt on partial reinforcement schedule. In human situations the superstitious behaviour and the behaviour of gamblers are hard to extinguish as they are learnt on a partial reinforcement schedule.

The only possible exception to the general rule that extinction occurs following withdrawal of reinforcer is when an escape response is learnt to avoid negative reinforcement. In such cases a discriminatory stimulus will signal the organism of the imminent onset of the negative reinforcer. That these avoidance responses form the basis for preservation of neurotic behaviour will be shown in **the following section.**

Neurosis

Traditionally, neurotic behaviour patterns like phobia, anxiety states, masturbation, were explained and treated along psychoanalytic lines. Psychoanalysts consider neurotic behaviour as 'symptoms' or 'visible upshots of repressed unconscious urges' (Eysenck and Rachman 1965). The treatment was to remove the unconscious causes which would automatically result in the removal of symptoms. Now, there is a trend among many psychologists to consider neurotic behaviour as a **learned** behaviour. The learning of neurotic response is in no way different

from learning of desirable responses. In a nutshell, they consider neurotic behaviour to be a maladaptive habit. From this line of thinking, it logically follows that these behaviours can be extinguished—to which end all therapeutic efforts are directed.

A formal definition of neurotic behaviour, in the new sense, is in order at this stage. It can be defined as a maladaptive learned behaviour or undesirable learned behaviour—undesirable from the point of view of society or law. However, neurotic behaviour also includes a failure to acquire a desirable response.

Phobia, anxiety states and so forth are included under maladaptive learned behaviour category. Homosexuality, psychopathic behaviour, masturbation and so forth are included under undesirable learned behaviour category. Enueresis can be cited under the lack of desirable behaviour category. It is a condition where enlargement of bladder and beginning of urination does not elicit the desirable response of waking up and going to toilet. Obsessive compulsive behaviour cannot be classified either as being completely maladaptive or undesirable; it is probably both.

Mowrer (1950), contemplating on the fact that a neurotic individual adopts his neurotic behaviour even though it is highly disadvantageous to him, calls it a 'Neurotic Paradox'. He goes on to comment that 'commonsense holds that a normal, sensible man, or even a beast to the limits of his intelligence, will weigh and balance the consequences of his acts; if the net effect is favourable, the action producing it will be perpetuated; and if the net effect is unfaourable, the action producing it will be inhibited, abandoned. In neurosis, however, one sees actions which have predominently unfavourable consequences; yet, they persist over a period of months, years, or a life time. Small wonder, then, that commonsense has abjured responsibility in such matters and has assigned them to the realm of the miraculous, the mystical, the uncommon, the pre-natural' (Mowrer, 1950, p. 3.)

It has been the task of some workers in this field to show that appearance can be different from reality and that the seemingly true observation that neurotic behaviour goes against simple cannons of learning is more apparent than real.

One of the noted contributions in this direction was made by Eysenck and Rachman (1935) who present formation of maladaptive responses in three stages. The first two relate to the acquisition and the last to the maintenance of the learned behaviour. This last stage is of particular significance to a clinician because it forms the logical focus of his attack.

These three stages of formation of maladaptive behaviour will be abstracted from an epoch-making experiment conducted by Watson and Rayner (1920). However, before doing this, passing reference must be made to the fact that Pavlov induced experimental neurosis in his dog by trying to train it to make finer and finer discrimination between positively reinforced stimulus—a circle, and an inhibitory, unreinforced differential stimulus—an elipse. When discrimination was no longer possible, all previously elaborated differentiation were brought to naught, and the dog's behaviour sharply changed. The dog was continuously

excited and restless, tore the instruments attached to him, and refused food (Alperan 1967). This nervous breakdown is similar to that which is seen in human beings. Though the experiment itself does not give a full explanation of neurotic behaviour exhibited by human beings it provided a stimulus for thinking that human neurosis may be learned.

Watson and Rayner (1920) following the Pavlovian paradigm, instituted fear response to an innocuous white rabit in a child called Albert. The experiment essentially consisted of presenting loud noise while the child was playing with the rabbit. The strong, disorganising autonomic response elicited by loud noise became conditioned to the white rabbit. The scheme for this conditioning is given below:

Before experiment

Rabbit elicits play response.

Experiment

Rabbit elicits play response.
Loud noise (UCS) elicits strong, disorganising autonomic response (UCR).

After experiment

Rabbit elicits strong, disorganising autonomic response. Hence, Albert tries to avoid it.

The fear response was generalised to objects like wool, and rats, which remotely resembled the rabbit, except in being white in colour. Albert started to avoid all these objects at first sight.

We can now abstract the three stages of formation of maladaptive behaviour from this experiment. In the first stage a single traumatic event—the loud noise in the case of Albert, or else a series of sub-traumatic events, produce a strong unconditioned disorganising autonomic response of sympathetic origin. This in itself is not neurotic as they are universal and not persistent.

In the second stage, previously neutral or indifferent stimulus or stimuli—the rabbit in Watson's experiment, probably also the room in which the experiment was conducted—acquire the property of eliciting the strong disorganising autonomic response. This actually is a neurotic response.

It logically follows from the Pavlovian paradigm that a conditioned response which is not reinforced begins to be extinguished. Therefore the conditioned response of the type of Albert's would be extinguished if the individual frequently faced the original traumatic conditioning events in the absence of reinforcement. As this is usually the case the majority of maladaptive learned behaviour show spontaneous remission. It is reported that about 70 per cent of neurotic responses of the maladaptive category show spontaneous remission (Eysenck and Rachman 1965).

The fact that not all cases show spontaneous remission necessitates the postulation of the third and the final stage in the formation of maladaptive learned behaviour. The dogs in Pavlov's experiments and human beings in human situations differ in one significant respect. The dogs were strapped and when the conditioned stimulus was repeatedly presented without reinforcement, the dog had no chance but to see or hear it and let the extinction occur. But human beings have an important choice, 'he can choose to watch the stimuli and let the extinction occur, or he can choose to avoid the stimuli or indeed run away' (Eysenck and Rachman 1965). The avoidance response of running away from the conditioned stimuli is being reinforced (in the operant sense) by the non-arousal of the sympathetic system. This is well illustrated in the case of Albert who tried to avoid the conditioned stimulus—rabbit. The avoidance response was reinforced because Albert found relief in adopting avoidance response.

It should be emphasised that if the situation in which the conditioning occurred resembled any other situation to a greater or a lesser extent, the autonomic response would generalize to these situations. The person then starts avoiding them also. This is seen in the neurotic response of widespread anxiety. The only good example where discrimination plays a role is in phobia, where the reactions are specific to a stimulus—as in hydrophobia, claustrophobia, etc.

The learning of undesirable responses follows a slightly different line in that initially a positive, appetitive conditioning occurs contrary to the rules and laws of the society. The reinforcement for these responses say, for homosexuality, perverse erotic behaviour etc., is in the form of orgasm. Extinction of such responses does not occur easily as immediate consequences of the acts have greater reinforcement value than the punishment administered sometimes after the act is over. The therapist has to administer a negative reinforcer stronger than pleasurable consequences such that it precedes the pleasurable consequences of the act.

Stuttering

In this final section the relevance of learning theory to an understanding of stuttering will briefly be mentioned.

Stuttering is one of the most challenging of speech disorders. It is a disorder characterised by unusual pauses and/or prolongations, and/or fixations, and/or oscillations accompanied with or without twitchings, tics and unusual postures. This disorder has been lately considered a maladaptive behaviour. The three important reasons for the new outlook on the problem are as follows.

(1) *Spontaneous remission of stuttering:* Shearer and Williams (1965), Wingate (1964), and Sheehan and Martyn (1966) have reported on spontaneous recovery of stuttering. Wingate and Sheehan and Martyn conducted their studies to isolate factors related to spontaneous recovery. The Sheehan and Martyn study

has indicated that some 80 per cent of the stutterers recover spontaneously. This is in close agreement with what has been reported by Eysenck for other neurotic behaviour. This lends ample support to the consideration of stuttering within the modern theory of neurosis. On the analysis of their data on the specific question 'To what do you attribute your recovery'? Sheehan and Martyn found that out of 32 recovered stutterers 11 attributed it to 'slowing down and relaxing', 8 to 'speaking more and improved self-concept'; and interestingly, only one person attributed to 'Speech Therapy'. Remaining 12 answered 'Don't know'.

One of the behaviour therapeutic techniques, desensitization, uses relaxation to counteract anxiety; in other words a parasympathetic reaction (relaxation) counteracts anxiety (sympathetic reaction). This actually forms the core of the desensitization technique. Interestingly 11 out of 28 who could specify the reasons, attributed their improvement to relaxation which obviously counteracts the anxiety that underlies stuttering response. Sheehan and Martyn (1966) hold that the improved self-concept results in greater fluency. However, it is possible to interpret that if the case goes ahead, faces the conditioned stimuli, talks more and thus lets the extinction occur the feedback of this improved performance results in an improved self-concept.

(2) *Stimulus control of stuttering behaviour:* It is invariably reported by a stutterer that he stutters differently with different individuals and/or differently in different situations and/or differently with different sounds and words. This is in strict accordance with the Pavlovian paradigm where the occurrence of a conditioned response depends on the presence of a certain pattern of conditioned stimuli.

(3) *Effectiveness of behaviour therapy:* The success reported by many speech therapists can be traced to their use of learning theory principles though many of them have given different explanations. For example Van Riper, noted for his success in stuttering therapy has used among others, desensitization, 'faking' and also psychotherapy as therapeutic techniques. All this can be shown to be minor forms of behaviour therapies when they are shorn of their inessential and irrelevant parts.

The three evidences discussed in this paper are only a few of the large number of evidences in favour of the consideration that stuttering is a maladaptive conditioned response. A discussion of all these evidences, however, is beyond the scope of the present paper. Such a consideration should lead to the development of therapeutic techniques specially suited to stuttering. For all purposes, Behaviour Therapy goals are well defined. It is either extinction of maladaptive and undesirable responses or building up of missing stimulus response connections. Though it is true that stuttering should be extinguished, it does not necessarily mean that it is as easily achieved as in the case of dogs or for that matter, in cases of phobia. It is often found that problem faced by an applied science is as baffling as the problems faced by a pure science; the extinction of stuttering may be one

such problem. We should look forward to the development or modification of existing techniques for extinction of neurotic behaviour specifically to suit stuttering behaviour.

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