STRATEGIES TO IMPROVE GENERALIZATION[1]

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This chapter provides descriptions and examples of the types of problems which can prevent generalization, and explanations and descriptions of strategies that can remediate these problems and facilitate generalization. Additional applications and information about the strategies may be found in White, et al (White, Liberty et al., 1988). The decision rules presented by Liberty (1988) can guide the identification of the type of problem experienced by a learner in a particular generalization situation and thus the selection of a category of strategies from which a specific technique may be selected.

The first category is designed for skills which are to be generalized to only a few situations. Subsequent categories include strategies designed to remediate problems caused by noncontingent reinforcers, competing behaviors and competing reinforcers; problems with the nature of reinforcement or other consequences, problems affecting the discrimination of appropriate stimuli in the generalization situation, and problems with the general format used to program for generalization.

Limited Generalization Situations

Generalization may occur across many different dimensions (see Chapter 1, Haring, 1988b), although generalization across settings is the term often described in the professional literature (c.f., Falvey, 1986). Some skills are very setting-specific. For example. you may target grocery shopping, which involves skills specifically appropriate for grocery stores. Generalization is therefore "limited" to grocery stores, but a great many other dimensions of generalization must be considered — new items on the shopping list, items in different sections of the store, different checkers, and different stores, just to mention a few. So, you can see that although the *general* setting is specific, there are many situations to which generalization may be desired. It may be possible to train generalized skills in a few representative settings, but training in one or two "natural" settings may not result in generalization across all of the desired situations (see Chapter 2, White, Liberty et al., 1988). However. it is possible to identify some skills which are applicable in only a very few situations, and which have very few dimensions across which generalization is desired. The strategy of "train in desired situation" is designed to avoid generalization problems for the latter class of skills.

If you desire the behavior to be performed in many different untrained situations, as when expressive communication of "yes" and "no" is desirable in the classroom, the home, and the community, and with all the people, question-types, inflections, etc., that the student will ever encounter, this strategy is not appropriate. It is improbable that you would be able to provide

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instruction *in all* of these situations, so strategies which facilitate generalization across situations (as those discussed in subsequent sections of this chapter) are likely to be more efficient than trying to teach all of the settings and dimensions of generalization where the skill is desired.

If the behavior *is* desirable in only a limited number of situations, it may be most efficient to simply train the behavior in the situation(s) in which it is desired — if it is *possible* to provide training in those situations.

Strategy: Train in the Target Situations

This will be efficient if the behavior itself is appropriate only in one situation, or in a very small number of situations, and if it is possible to conduct training in those situations. This strategy can be applied to behaviors that are designed for only two or three situations by training first in one situation, then in a second, then in a third. Stokes and Baer (1977) called this "sequential modification." Articles that describe training in the desired situation are listed in the bibliography at the end of this chapter.

If it is not possible to train in a particular situation, or if it is impossible to train in *all* situations, you can provide instruction in one setting, *probe* for generalization in other situations, and use the other strategies described in this chapter to facilitate generalization.

Problem and Solution, Example 1. Doug moved into the Ravenna Avenue Group Home when he turned eighteen. The director has requested that Doug learn how to operate the washer and dryer. Ms. Anderson, Doug's teacher, looks over Doug's current schedule. Most of his time is spent in vocational training. Doug has been progressing well as a bakery trainee, and now works part-time at the Tastee Bakery. It looks like Doug will eventually be living in the group home and working full-time at Tastee Bakery after he graduates from high school. Ms. Anderson decides that the most efficient way to teach Doug to use the washer and dryer at the group home is to provide instruction there. She visits the group home and inspects the washer and dryer, talks with the director, and several of the residents. A young man from a local church volunteers to teach Doug and several other residents how to wash and dry their clothes. Ms. Anderson and the director develop the program and assist the volunteer in learning how to run it. Doug is trained directly in the situation in which the skills will be applied, so in this case skill mastery will mean skill application in the desired setting.

Noncontingent Reinforcer, Competing Behavior, and Competing Reinforcer Problems

Sometimes reinforcers that are naturally available for performing new instructed behaviors are provided whether the pupil performs those behaviors or simply does nothing. When that happens, we refer to *noncontingent reinforcement*. A frequent result of noncontingent reinforcement is that the pupil will fail to perform the instructed behavior in a reliable manner, if at all. In other cases, competing behaviors may be reinforced in generalization settings. *Competing behaviors* are those which exist in a pupil's repertoire prior to instruction which function to access the reinforcers which are naturally available for performing the new, instructed behavior. The maintenance of competing behavior may result in pupils performing those behaviors rather than the instructed behavior outside of the training situation. A similar outcome may occur when attention or other consequences follow undesirable behavior and thereby compete with the reinforcer available for the target behavior. If a reinforcer which follows an undesirable behavior is different from and stronger than that which follows an instructed behavior, a *competing reinforcer* problem exists and the undesirable behavior may be the one which is performed.

The following examples illustrate noncontingent reinforcer, competing behavior, or competing reinforcer problems, as identified at the end of each example. Interventions designed to facilitate generalization in each case are described later in this section.

The function of strategies described in this section is to ensure that the instructed behaviors emitted by pupils result in more effective reinforcement than (1) the absence of such behaviors or (2) other, undesirable behaviors.

Problem, Example 2. Robert is learning to hold his head up. During instruction, his teacher sits next to him and praises him and talks to him as long as his head is up. When his head is down, she moves away. Although Robert will now keep his head up whenever his teacher is near, the rest of the day his chin is on his chest. The teacher notices, however, that other people and classmates come up and talk to Robert anyway.

Because the attention and activity are available whether or not Robert has his head up, this is a *noncontingent reinforcer* problem.

Instructed Behavior:	head up
Natural Reinforcer:	see people, attention, activity
Noncontingent Reinforcer:	attention, activity

Problem, Example 3. Sally's teachers are delighted that she has learned how to answer yes/no by pointing to large colored figures taped to her wheelchair tray table. Despite her severe cerebral palsy, Sally answers her teachers quickly and consistently. However, she is answering her peers and other adults more slowly and much less consistently.

Observation of the natural consequences for Sally's answers showed that the adults with whom she interacted tended to either ignore her answers (e.g., Sally was given popcorn even after she answered "No" to the question, "Do you want some popcorn?"), ask questions where Sally really had no choice (e.g., "Do you want to go home?" — asked as she was being put on the bus), or to ask questions without waiting for an answer.

Because the attention and activity are available whether or not Sally answers questions, this is a *noncontingent reinforcer* problem.

Instructed Behavior:	answer question
Natural Reinforcer:	objects and events provided by others
Noncontingent Reinforcer:	objects and events provided by others

Problem, Example 4. Todd is 8 years old and has spina bifida. For the last several years, his primary means of locomotion when out of his wheelchair has been to scoot along the floor in a sitting position. Last year. his teacher and his parents agreed to work on alternatives for independent locomotion more closely approximating normal styles of locomotion, since Todd was getting pretty big to scoot around. The teacher implemented a 10 step instructional program to teach him to walk with crutches. After 7 months, he could get around on crutches without assistance. When she reported his progress to his parents, they purchased crutches for Todd to use at home.

Todd has a new teacher this year, and he assessed Todd's walks-with-crutches behavior. Todd's rate had slipped considerably from where it was at the end of the previous year. His teacher instituted a program that required Todd to use the crutches frequently, and within a few weeks Todd met his previous aim. In preparation for the IEP meeting, the teacher called Todd's parents, who reported that Todd never used his crutches at home. According to his father, "Todd just loves to scoot."

Because the reinforcer of getting from one place to another is natural to both walking and scooting this is a *competing behavior problem*.

Instructed Behavior:	walks with crutches
Natural Reinforcer:	gets quickly to desired place
Competing Behavior:	scoots on fanny

Problem, Example 5. Sharon, who is nonverbal, grabs for what she wants, rather than indicating her desires with a more appropriate request behavior whenever food is served family style. Her teacher decides to teach Sharon to point for desired food items at lunch rather than to grab for them. The teacher wants Sharon's pointing to generalize to other situations, so she also assesses Sharon's behavior at morning snack time in another room with a different manager. Sharon grabs there, too.

After four days of the program, she was pointing all but once or twice during lunch. During snack, however, Sharon didn't do so well. She continued to grab much more than she pointed, even after she met her aim in training.

Because the natural reinforcer of getting what she wants is available for both pointing and grabbing, this is a *competing behavior problem*.

Instructed Behavior:	point for food
Natural Reinforcer:	food
Competing Behavior:	grabs food

Problem, Example 6. Chris learned to dress himself as a result of his teacher's systematic dressing program. At the end of the program, he could put on his shirt, pants, socks, and loafers.

At home, he screams rather than get dressed — ear-splitting, nerve-shattering screams — and he continues screaming until his mother dresses him. Whenever his mother tries to encourage Chris to dress himself, his screams escalate into full-scale tantrums, complete with clothes-tearing and breath-holding, and getting him dressed takes forever.

Because Chris's mother dresses him, the reinforcement is available even if he does not dress himself. This is probably a *competing behavior problem*.

Instructed Behavior:	puts on shirt, pants, socks and shoes
Natural Reinforcer:	gets dressed/goes onto next activity
Competing Behavior:	screams and tantrums

In this example, a *competing reinforcer* in the form of attention from Chris's mother for tantrums may also be present. Obviously, more than one problem can exist at a time.

Problem, Example 7. Colin, who is 4 years old and nonverbal, enjoys being hugged and cuddled by his parents. To get what he wants, he has learned to walk up to his mother or father and bang his head on the most convenient object. The refrigerator produces an excellent deep tone, and the floor is always available. When he emits this dramatic behavior, his parents almost always pick him up and cuddle him, regardless of what else they might have been doing.

His teacher realizes that head-hanging brings attention, so he decides to teach Colin an alternative behavior. He instructs him in the use of the Exact English manual sign for “hug” and, very soon, whenever he wants a cuddle at school, he signs “hug” for it.

At home, however, his parents sometimes ignore or miss seeing the sign. Before long, Colin begins to bang his head again at home, although maintaining the more desirable communicative behavior in the classroom.

Because the natural reinforcer for the "hug" sign (attention and cuddling) also follows head banging, this is a *competing behavior problem*.

Instructed Behavior:	signs "hug"
Natural Reinforcer:	attention. cuddling
Competing Reinforcer:	head-banging

Problem, Example 8. When undesirable behaviors are maintained by their own, particular reinforcers, it is common that systematic behavior deceleration programs are developed and implemented in training settings concurrent with programs designed to build new, functional behaviors. Typical behavior deceleration strategies might include, for example, differential reinforcement of other behaviors (DRO), response cost, and timeout. This example, and the associated solution, reflect the presumption that many failures of skill generalization due to competing reinforcers are actually failures to obtain generalized suppression of the undesired behavior.

Terry's rather dramatic stereotypic behaviors (hand flapping and "light filtering") have been brought under control in his elementary school classroom by using DRO. Generally, he makes good progress in programs designed to teach functional skills in training situations where natural outcomes (including praise) are used as the principle reinforcers. Many of the skills he has learned, however, fail to carry over into other areas of the school, his home, and other nontraining environments, even though members of the school staff and his parents compliment Terry's efforts on appropriate occasions. Large amounts of Terry's time outside of the classroom are spent engaging in stereotypic behavior.

Because Terry performs an activity other than the instructed behavior and the consequences for that activity appear to differ from those which follow instructed behaviors, this could be a *competing reinforcer problem*.

Instructed Behavior:	various functional skills
Natural Reinforcer:	verbal praise
Undesirable Behavior:	hand flapping, light filtering
Competing Reinforcer:	sensory stimulation

How to Identify Natural Reinforcers

Reinforcers are events which immediately follow the response, and which increase the probability that the behavior will occur again. Behaviors that are reinforced either accelerate (i.e., occur with increasing frequency) or are maintained at levels sufficient to access reinforcement. To identify possible reinforcers. observe other individuals performing the target behavior in the generalization situation(s) and record all of the events which follow the performance of the desired response (an example is shown in Table 1).

Table 1: Example of Observation to Determine Natural Schedule of Reinforcers
Events shown below occurred during the generalization situation. Natural reinforcers for "lifts head" include being able to see what's going on around you, and the opportunity for social contact.

Response: Lifts head and holds head up
Aim: 100% of the time

Time of Day	Student Behavior	Event Following
9:00	head down	No activity near student.
9:01	"	"
9:02	"	"
9:03	lifts head	"
9:04	head down	"

Time of Day	Student Behavior	Event Following
9:05	"	"
9:06	lifts head	Peer says "Hi" to student.
9:07	head up	Peer and Teacher set up puppets in vicinity of student; student watches.
9:08	"	Teacher finishes setting up puppets, moves away from student.
9:09	head down	No activity near student.
9:10	"	"
9:11	lifts head	"
9:12	head down	"
9:13	"	Teacher and group of students come over to the puppets.
9:14	lifts bead	Teacher/pupils play with puppets.
9:15	head up	Puppet "talks" to student.
9:16	"	Puppet "talks" to student.
9:17	"	Puppet goes to another student.
9:18-9:23	"	Puppets talking to students.
9:24	"	Teacher & students put puppets away.
9:25-9:35	head down	No activity near the student.
9:36	lifts head	"
9:37-9:40	head down	"

Total Observation Time: 40 minutes
"Lifts head" was followed by a natural reinforcer twice. The reinforcing nature of these events is easy to identify, since in both cases the student continued to keep her head up until the event ceased.
This schedule is: VR 2(4 responses, 2 reinforced) and
VI 20' (40 minutes, 2 reinforcers)

If you have time for multiple observations, you may be able to determine which of the events you observed in the generalization situation are the actual reinforcers, but even with successive observations, it may not be clear. Therefore, it might be better to assume that all of the events act to reinforce the behavior. Remember, behavior may be reinforced by the termination of events, and even by the occurrence of events that you might think are obnoxious.

How to Identify Noncontingent Reinforcers, Competing Behavior, and Competing Reinforcers

Observe in the generalization situation. Write down the exact behavior of the student including the instructed behavior if it occurs, and any other behavior, especially if you think it is inappropriate.

Next, write down the exact events which follow each behavior — including the activities and words of other people, changes in the environment. etc.

As a result of your observations, you should be able to identify the competing behavior and the natural reinforcers, as well as any events which might be reinforcing the competing behavior. If those reinforcing events differ from the natural reinforcers which follow the instructed behavior, they are probably competing reinforcers.

Many undesirable behaviors that may at first appear to have consequences which are different from trained behaviors ultimately result in the same consequences. For example, self-injurious behavior may result in escape from a task. Some of the consequences that follow escape may be different from those which are likely to follow task performance; however, escape may also allow access to many of the same consequences (i.e., the opportunity to engage in a more pleasurable activity). It is recommended, therefore, that a competing reinforcer problem be

identified only after strategies for noncontingent reinforcers or competing behaviors have been tried with unsuccessful results.

Strategy: Increase Proficiency

Increase the relative efficiency of the instructed/desired response by increasing the performance aim for the target skill, and then reinstate instruction in the training setting to build fluency to that level. This should insure that the new skill will access reinforcers more efficiently than the competing behavior.

How to Determine a Competitive Performance Aim

In the training situation, determine how quickly the student obtains reinforcement for the target response. With a stopwatch, measure the time from the beginning of the response or response chain until the time the reinforcer is obtained. You may need to collect data for several trials to determine the average length of time.

In generalization situations, determine how quickly the student is reinforced for the competing behavior, using the same procedures as for the target behavior. Compare those data. If the competing behavior results in faster reinforcement than does the target behavior, set the fluency aim for the target behavior to be faster than the competing behavior.

Solution, Example 4 (Competing Behavior). In Todd's situation, although he walked with crutches fast enough to satisfy his teacher, it was still more efficient for him to scoot to get what he wanted. His teacher reasoned that if Told could crutch-walk faster than he could scoot, then he would use the crutches. He measured the speed of Todd's scooting and established a new aim for walking which was faster than the scoot rate. Then he reinstated the instructional procedures he had used at the first of the year until Todd met the new aim. Sure enough, when Todd found out that he could get around faster with crutches, he stopped scooting at home.

Strategy: Amplify Instructed Behavior

Determine whether the new behavior is capable of reliably securing the available natural reinforcer in the generalization setting. If it isn't, then additional instruction in the training setting to modify or augment the instructed behavior may be required.

Solution, Example 4 (Competing Behavior). In Todd's case, it was possible for the teacher to increase his crutch-walking proficiency until he met a competitive performance aim. In some mobility training programs, however, such a strategy might not be effective. For example, an objective might specify independent walking as an outcome. After considerable instructional effort, however, it might be found that the pupil is unable to achieve a faster rate of walking than crawling due to physically handicapping conditions. The “amplification” strategy under these circumstances could potentially involve the use of equipment that would facilitate efficient locomotion — perhaps the use of a walker or crutches would do the trick.

Solution, Example 7 (Competing Behavior). The sign Colin learned was simply too easy to ignore or miss in a nontraining environment, unlike his head banging, which was almost impossible to miss. Head banging functioned both to get his parents' attention and to get hugged.

An appropriate intervention would be to teach Colin some behavior which would get his parent's attention, but which would be less dangerous than head banging — like tapping his parents' arm. Once he had his parent's attention, he could then sign “hug” for his cuddle.

Strategy: Alter Generalization Contingencies

In the case of noncontingent reinforcer and competing behavior problems, ask people in the generalization situations (or train them, if necessary) to allow only the new behavior to access reinforcers. This strategy is designed to increase the reliability of the new behavior in securing reinforcers and to decrease the reliability and/or efficiency of any old, competing behavior.

In the case of competing reinforcer problems, ask a variety of people in generalization situations to use the deceleration procedure employed in training settings. Provide training as necessary. The purpose of this strategy is to both reduce the relative strength of reinforcers associated with undesirable behaviors and to establish individuals in nontraining environments as effective stimuli for the control of those behaviors. It is possible that, as the student experiences multiple examples of situations in which deceleration tactics will be applied, a more generalized reduction across additional settings and people will be observed. Where it is difficult for relevant individuals (e.g., parents) to apply the deceleration procedure in generalization settings, it may be possible to "preprogram" such individuals as controlling stimuli by inviting them to participate in administration of the procedure within the school for a short period of time each day (cf., Marholin, O'Toole et al., 1979).

Solution, Example 2 (Noncontingent Reinforcer). Robert's teacher could either ask people to ignore him when his head is down and to talk to him when his head is up, or else put a sign on his wheelchair requesting this. As long as the reinforcer is available for doing nothing, there is no "reason" for Robert to engage in the behavior.

Solution, Example 3 (Noncontingent Reinforcer). One might alter contingencies for Sally to answer questions. Adults could be asked to pay attention to Sally's answers and to avoid asking meaningless questions. Generalization probes could then be extended to untrained questioners. A small sign could be put on Sally's wheelchair requesting that questioners follow such procedures; one might probe to determine if such a procedure was effective in altering questioner contingencies, although certainly the original conditions of generalization have been altered.

Solution, Example 5 (Competing Behavior). For Sharon, the grabber, the intervention during snack consisted of two steps. First, contingencies were altered so that only pointing was successful in obtaining food — increasing the reliability of pointing. This was accomplished by a simple intervention (cf., Billingsley & Neel, 1985) — if she grabbed, the food she grabbed was taken away from her for a period of time. This decreased the reliability of the old behavior.

Second, because it was highly unlikely that pointing could ever become more efficient than grabbing, a procedure was implemented in which grabbing resulted in a delay of opportunity to point — Sharon's bands were held in her lap for I5 seconds after a grab. As a result, Sharon began to point in order to request food during snack as well as at lunch.

Solution, Example 6 (Competing Behavior and, perhaps, Competing Reinforcer). For Chris, who wouldn't get dressed at home, the teacher recommended first of all that his mother ignore the screaming. Second, the teacher suggested that Chris simply not be allowed to come downstairs for breakfast until she was dressed — the usual sequence of events in the household. Third. it is recommended that his mother increase her attention to Chris for independent dressing as a "replacement" for affection that would be lost when she ignores tantrums. Everyone concerned realized that this meant that Chris would probably be late to school a few times — not to mention that his screams would likely get more frequent and louder right away.

The teacher dropped by his house on her way to work during the first 3 days of this intervention to provide his mother with support, encouragement, and advice. The success of this intervention depended on ensuring that only independent dressing is reliable in permitting access to reinforcement in the form of participation in post-dressing activities

Solution, Example 7 (Competing Behavior). Colin's teacher might have asked Colin's parents to keep a careful watch for his "hug" signs and to hug him only alter he signed, allowing only the new behavior to access the reinforcer; and to briefly but firmly restrain him when he banged his head.

Solution, Example 8 (Competing Reinforcer). The DRO procedure was applied to Terry's hand flapping and light filtering by other individuals within the school (PE and music teachers, classroom volunteers) across settings (gym, band room. hallway, playground). In addition. his parents were taught to use DRO and they agreed to employ it on a consistent basis at least in their home. His grandfather, with whom Terry spent considerable time, visited the classroom for an hour a day and participated in administering the DRO program.

New Probe Situations

Chris can now dress himself at home and at school. Sharon now points for food at lunch and snack. In both cases, the natural events in the generalization situation were changed. Is generalization to other situations desired? If so, you must assess generalization in additional settings. Can Chris get dressed after swimming? Does Sharon point at the buffet line at the Royal Fork Restaurant?

It is possible that once the learner has experienced altered contingencies in several settings, generalization across other situations will be observed in the absence of additional programming. If generalization is not occurring, however, you must stop and reconsider using this particular strategy. Is it reasonable to suppose that many other people who meet Chris and Sharon in other situations will impose the altered contingencies? Can you "engineer" the application of such contingencies in a variety of situations? If not, then perhaps you may want to try an intervention strategy that does not rely on altering conditions in the generalization situation.

Reinforcing Function Problem

Behaviors are maintained by reinforcement. If reinforcement does not follow, or fails to occur often enough, the behavior will cease to occur. If the target behavior has been performed once appropriately in the generalization situation, it has transferred. If, however, the behavior does not occur again in the new situation under the same stimulus conditions, or if it occurs erratically, the problem is likely to be with reinforcement. Examples of possible problems are followed by an explanation of strategies which can be used in training to prevent, alleviate, or correct the problem. Additional examples may be found in the articles listed in the bibliography at the end of this chapter.

Problem, Example 9. The students in Ms. Zee's class operate a salad bar. During the last part of the school day, Jay has been taught to collect the salad bowls, wash and dry them, and put them away. Jay has met all of his teacher's aims for accuracy and speed which were set to match workers in the cafeteria. Then, Jay is considered for a job with a sheltered workshop which sends out teams of house cleaners. On the first day of Jay's placement evaluation, he is asked to wash, dry, and put away dishes in the client's house. He washes and dries all of the dishes, and puts them away, searching cupboards and drawers for reasonable storage places. The evaluator records Jay's work on his placement form. The next time Jay is asked to wash, dry, and put dishes away, however, he simply runs them under a lukewarm tap (i.e., no soap, no scrubbing, no clean dishes), and stacks them in the dish drain.

Problem, Example 10. Scott has learned to pick up and hold a variety of objects. This is a big step for him at twelve — with his severe athetoid cerebral palsy and his frequent seizures, no

one had been able to teach him this skill before. Scott's teacher, however, shaped the behavior by following little increments of change with Merle Haggard's music. Now, Scott will hold the objects as long as the music's coming through his earphones! Although this program has taken quite a bit of time, the instructor is pleased — at least Scott will have something to do during the times he must work with other students.

However, once Scott's teacher started putting other objects in front of Scott during other times of the day, he was disappointed. Scott would occasionally pick up one of the objects, but then he would drop it right away — he hadn't generalized the "hold" part of the response.

Problem, Example 11. Tina is learning to fold sheets, pillow cases, and towels. In the training situation, Tina's work is checked frequently and she has to refold any misfolded items. Her teacher praises her about every 5 minutes for working and for staying on the job. At the end of the 3-hour training session in the school laundry room, Tina is given a check for $9.75. In the afternoons, Tina is learning about saving and spending the money she earns.

At the end of the school year, Tina's teacher and supervisor find a summer vocational program which provides an actual summer job like many teens have. Tina proudly goes to work at the local hospital laundry. After a week, however, Tina is fired — she is making too many mistakes, and is spending lots of time looking around instead of working.

Problem, Example 12. Anne's teachers are delighted that she has learned how to answer yes/no by pointing to large colored figures taped to her wheelchair tray table. Despite her severe cerebral palsy, Anne answers her teachers quickly and consistently. However, she is answering her peers and other adults more slowly, and much less consistently.

Strategy: Program Natural Reinforcers

Introduce the reinforcers which occur naturally in the generalization situation into the training situation to ensure that those events will functionally reinforce the instructed behavior.

Reinforcers

Reinforcers are events which immediately follow the response, and which increase the probability that the behavior will occur again. Behaviors that are reinforced either accelerate (i.e., occur with increasing frequency) or are maintained at levels sufficient to access continued reinforcement.

The events that are available as reinforcers in the generalization situation must acquire reinforcing properties with respect to the instructed behavior. Although certain general classes of events are usually considered to be reinforcers — verbal and physical attention, food when hungry, drink when thirsty, additional clothing/campfires/hot drinks when cold — reinforcers do not have universal properties. That is, an event which reinforces one behavior will not necessarily reinforce another behavior. Also, an event which reinforces a behavior in one situation may not be available in another situation, or even if it is available, it may not reinforce the behavior. Therefore, it may be necessary to introduce the client to the events which do occur naturally in the generalization situation in such a way that they acquire reinforcing properties with respect to the specific instructed behavior.

How to Identity Natural Reinforcers

Observe other individuals performing the target behavior in the generalization situation(s) and record all of the events which follow the performance of the desired response (an example is shown in Table 1 on page 5).

As mentioned before, if you have time for multiple observations, you may be able to determine which of the events you observed in the generalization situation are actual reinforcers, but even with successive observations this may not be clear. Therefore, it might be better to assume that all of the events act to reinforce the behavior. Remember, behavior may be reinforced by the termination of events, and even by the occurrence of events that you might think are obnoxious.

Pairing and Fading

During training, whenever you present the training reinforcers, also present the events that will commonly follow the behavior in the generalization situation. This process is called pairing. The natural events should acquire reinforcing properties because they are associated with events already functioning as reinforcers — the events you used during training must be reinforcing — after all, the student *did* meet your aim!

Gradually decrease the use of the training reinforcers until the natural reinforcers alone control the behavior. This process, which is also known as "fading," should continue until the natural reinforcers produce performance identical to that desired/controlled by the training reinforcers.

Solution, Example 8. Ms. Zee used this strategy in retraining Jay. She talked to the sheltered workshop coordinator, who described the work situation. It seems that Jay will be selected to wash, dry, and put dishes away, and then should ask for another job. During her earlier training, however, Ms. Zee had used extensive verbal praise, which is not available in this job situation. In retraining, she decides to continue the verbal praise, which is a known reinforcer, but to pair the praise with the opportunity for Jay to ask for and select another activity. She gradually reduces the praise (i.e., fading), until the opportunity to ask for and select another task controls the instructed behavior.

Strategy: Eliminate Training Reinforcers

Eliminate reinforcers used during acquisition and fluency-building in the training situation. First, compare your list of events which occur naturally in the generalization situation (see *How to Identify Natural Reinforcers*, page 5) with the reinforcers in effect in the training situation at the time the student met the training aim and/or at the time the generalization problem was identified. If the lists are not identical, then reinforcers that are present in training, but not available in the generalization situation, should be gradually eliminated from the training situation.

Often during acquisition and fluency-building, teachers will reinforce behavior with events which do not normally follow the behavior. When these reinforcers do not follow the student's behavior in the generalization situation, he may simply quit responding. When this happens, control of the response must be shifted from the non-natural reinforcer to the naturally occurring reinforcer by gradually eliminating (i.e., fading) the non-natural event(s). Steps similar to those described for introducing natural reinforcers into training situations may be used.

Solution, Example 9. Every time Scott picked up and held an object, he was reinforced with Merle Haggard's music. His teacher used several steps in fading the reinforcing music.

Identify the natural reinforcer. The natural reinforcer for picking up and holding an object is likely to (a) be related to the nature of the object and (b) include doing something with the object. For example, the natural reinforcer for picking up and holding a chocolate bar is being able to eat it, or see it better, or to be able to give to Kathleen, etc. Scott hadn't learned to do much with objects, but he could feel them and look at them, and he did occasionally drop one, or

bring one up to his eye level. Come to think of it, he *could* do things with objects, even if they weren't very sophisticated.

Introduce the natural reinforcer into training. The event which *should* reinforce the response (seeing/manipulating the object) was always present, so the teacher didn't have to make any special effort to include it in training.

Eliminate the "teaching" reinforcer from training. Scott's teacher realized that if he simply stopped the music all at once, Scott would probably stop picking things up, too — just as had happened in the earlier generalization probes (i.e.. since there was no reinforcer, the behavior was extinguished). He thought about it. There were two simple dimensions he could use to gradually decrease the music — the length of time the music was on and the volume of the music. So he gradually decreased the length of time the music was on and gradually decreased the volume of the music. It took about two weeks, but, by that time, Scott was picking up all sorts of objects.

Strategy: Reinforce at Natural Schedules

Schedule the reinforcers used during training to occur according to the same schedule with which they occur in the generalization situation.

Schedules of Reinforcement

Schedules of reinforcement are used to describe when reinforcement is delivered or made contingent upon responding. The most typical schedules are:

Continuous. Every response is reinforced. This type of schedule is often used during acquisition, when the teacher is likely to arrange for every correct response to be followed by a reinforcement.

Conjugate. Reinforcement occurs continuously as long as the response occurs. Again, this schedule may be used during acquisition. For example, Ms. Brittany turned on Scott's Walkman whenever he picked up an object (Problem, Example #9). The music stayed on as long as Scott held the object. When he dropped the object, or when it was taken away from him, the music was stopped.

Ratio. Reinforcement occurs after some number of responses — either a *fixed* number of responses or a *variable* number or responses. For example, if a reinforcer is delivered after every five corrects, the schedule is called a "fixed ratio five" (FR 5). If the reinforcer is delivered more randomly, but *averages* once for every five responses, the schedule is called a "variable ratio five" (VR 5).

Interval. Reinforcement occurs for the first response after a certain period of time has elapsed — either a *fixed* amount of time or a *variable* length of time. For example. if a reinforcer is delivered for the first response to occur after 5 minutes has elapsed since the last reinforcement, the schedule is called a "fixed interval 5 minutes" (Fl 5'). If the reinforcer is delivered more randomly, but averages once for every 5 minutes following the delivery of the last reinforcement, the schedule is called a "variable interval 5 minutes" (VI 5').

Observation to Identify Schedule(s) of Natural Reinforcers

Conduct your observations in the generalization setting. Observe a peer of your student perform the target behavior.

Write down the exact behavior and the time of day in which it occurs.

Write down the exact events which follow each behavior and the time they occurred. Events include the activities and words of other people, changes in the environment, etc. Events that immediately follow a behavior are the most powerful reinforcers, so focus your attention on them first. Remember, it is likely that some behaviors are ignored. By identifying how many are followed by some overt action and how many are not, you will be able to identify the natural schedule. Do the same events follow each behavior? Each part of the behavior? A whole string of responses? When there are multiple natural reinforcers, each one may be on a different schedule.

1. You may make a chart like those shown in Table 2, writing each event separately, to help you identify how schedules operate.

It is most likely that events you will observe occur on a mixed ratio/interval schedule. In order to determine the schedule, divide the total number of responses by the total number of events and divide the total time spent responding by the total number of events. This calculation should be performed separately for each potential reinforcer.

Maintenance and Generalization

The schedule with which a behavior is reinforced in training may affect both maintenance and generalization. Reinforcement delivered on a mixture of high ratios (i.e., many behaviors with few occasions of reinforcement) and long intervals (i.e., long periods of responding with few occasions of reinforcement) will help make the behavior resistant to extinction. If, however, reinforcement ceases, the behavior will probably extinguish — disappear over time. The speed with which a behavior extinguishes is usually a function of how often it has been previously reinforced. If every response has been reinforced, it will extinguish quickly when it is *not* reinforced. If a behavior has been reinforced frequently during training, and if that behavior is not reinforced the first or second time it occurs in the generalization situation, it may be extinguished in that situation. If the response has been reinforced infrequently and variably, it will maintain quite a long time before it is extinguished, and it is less likely to extinguish if the first few generalized responses are not reinforced immediately.

Table 2: Examples of Different Schedules of Reinforcement.

Response #	Fixed Ratio 5 (FR5)	Variable Ratio 5 (VR5)	Time Response occurred	Fixed Interval 5' (FI5')	Variable Interval 5' (VI5')
1			1:00		Reinforce
2		Reinforce	1:01		
3			1:03		
4			1:05	Reinforce	
5	Reinforce		1:06		
6		Reinforce	1:09		Reinforce
7			1:10	Reinforce	
8			1:13		Reinforce
9			1:14		
10			1:15	Reinforce	
11			1:18		Reinforce
12			1:19		
13			1:20	Reinforce	
14			1:25	Reinforce	
15	Reinforce		1:26		
16		Reinforce	1:27		
17			1:29		
18				1:30	

Response #	Fixed Ratio 5 (FR5)	Variable Ratio 5 (VR5)	Time Response occurred	Fixed Interval 5' (FI5')	Variable Interval 5' (VI5')
19				1:31	
20	Reinforce	Reinforce		1:32	
21		Reinforce		1:33	
22			1:35	Reinforce	
23				1:37	Reinforce
24				1:38	Reinforce
25	Reinforce		1:40	Reinforce	
Total Responses	Total Reinforcers		Total Time	Total Reinforcers	
25	5 Reinforcement follows every 5th response.	5 Reinforce *on the average* after every 5 responses	40:00	8 Reinforce for 1st response after 5' since last reinfrcm't	8 8 reinf. over 40 min. = 40/8 = VI5'

Implementation of Natural Schedules

In order to promote response maintenance, the schedule of reinforcement which controls responding in the training situation should resemble the natural schedule of reinforcing events in the generalization situation. The natural schedule should be gradually introduced into the training setting:

Identify the schedule of natural reinforcers.

Begin reducing the schedule of training reinforcement by increasing the criterion for reinforcement (e.g., increase the number of responses or the duration of responding required for reinforcement). Reduce the number of reinforcers delivered until it matches the natural schedule.

If you are unable to identify the schedule, then train the behavior to come under the control of a mixed variable ratio/variable interval schedule, with very high ratios and very long intervals.

Such schedules will help make the behavior resistant to extinction.

Solution, Example 10. Tina's teacher decides to visit the hospital laundry to see what goes on there. Workers in the hospital laundry are praised only occasionally, on the average once or twice per day, and they are paid every 2 weeks. Quality control checks are made very infrequently, and usually the worker is reprimanded and loses pay for too many mistakes — or is fired. The differences in the schedule or contingencies need to be corrected.

Tina's teacher decides to gradually reduce praise until it occurs only once or twice every two work sessions, and to gradually increase the time which Tina must wait for her pay until she is paid only every 2 weeks. The teacher also gradually reduces her feedback for errors, and "fires" Tina for the day if she makes too many mistakes. This strategy helped Tina get a permanent job, even after Tina was fired from the summer laundry job.

Strategy: Use Natural Consequences

In many situations, the instructed behavior is simply taken for granted — praise is not normally delivered by bystanders for appropriate table manners or for speeding through a grocery checkout stand or for crossing a street with the light. In such situations, the natural reinforcers are those provided by the event itself.

However, if behavior is not acceptable to persons nearby, the student may experience a different reaction. Unacceptable table manners in a public place may result in people turning away from the student, or making rude remarks loud enough to be overheard. Stalling the grocery line might result in persons moving away, or asking the student to "hurry up," or even by cart bumping. Crossing against the light might result in people yelling, grabbing the person, a jaywalking ticket, or even an accident.

These reactions, or ones similar to them, function for most or us as "socialized punishers" and decelerate the behavior they follow. Especially in the absence of more overt social reinforcers, they often have a controlling influence on our behavior if the student performs the instructed response in the generalization situation and it is ignored. The response may extinguish, which in turn may be followed by certain "social punishers" as well as by the absence of the natural reinforcers associated with appropriate performance. It should be possible to pair those natural consequences with the ones used during training to decelerate errors in a manner similar to the first strategy described in this section.

For example, observation could identify that when Anne does not answer a question, questioners usually (a) repeat the question, (b) ask another question, (c) make some excuse for the behaver (e.g., "Maybe you're too tired today") and finally, (d) walk away or turn their attention to another student. While event (d) is effective, Anne could learn that events (a), (b), and (c) will be followed by (d) if the teacher paired those events with (d) in the training situation.

Strategy: Teach Self-Reinforcement

If reinforcement is sparse or unidentifiable in the generalization situation, or if the response is not maintained in the generalized situation by the intrinsic reinforcers, one may teach the behaver to reinforce himself/herself. In this way, the student's self-reinforcement mediates the difference between the type and frequency of reinforcement required to maintain the behavior and what is actually available in the generalization situation.

In most studies of self-reinforcement, students are taught to deliver a token to themselves contingent upon the completion of the target behavior. These tokens are then later exchanged for special privileges, money, or other items. A list of possible self-controlled reinforcers is shown in Table 3.

Table 3: Sample Events Students Have Been Taught to Use for Self-Reinforcement

Immediate Event	**Backup Event**
A self-reinforcing event or self-monitoring behavior performed by the student immediately after the target behavior occurs. It serves to reinforce the target behavior	A self-reinforcing behavior or something performed by the teacher or other manager. This event is designed to strengthen the reinforcement for the target skill and provide additional "external" reinforcement for the "immediate event"
Uses a pencil to mark a "/" a piece of paper	Marks exchanged for free time
Actuates a mechanical counter (records points)	Points recorded on counter exchanged

Pushes a lever to record a count	Points recorded on counter exchanged
Pushes a lever to receive a token	Tokens exchanged
Marks a “+” On a piece of paper	“+’s” exchanged
Takes a coin from a cup	Opportunity to spend money
Verbally praises self out loud	Eventual follow-up praise from another person

You may teach self-reinforcement in the way that you would teach any other skill, using data collected on accuracy of delivery to make decisions about the effectiveness of instruction. The student is taught the criteria for reinforcing himself following the target behavior, and for not reinforcing himself following any other behavior. One must then probe to determine if the self-reinforcement behavior generalizes to the new setting. However, teaching the student self-reinforcement as part of training may improve generalization even if the student does not generalize the self-reinforcement behavior itself.

When selecting the nature of the self-delivered reinforcer, one must consider its portability. Will the student have access to the tokens in each setting in which the target behavior might occur? Will there be a means of exchange for items if that is needed? The tokens, points, or other immediate reinforcers may acquire and maintain strength even when they are not later associated with the original reinforcers (e.g., toys, privileges, money. etc.).

Solution, Example 11. Anne's teachers have been following a consistent plan for providing consequences for answering during training, but they realize that it would be impossible to train everyone else to follow the same plan. Instead, they decided to teach Anne to reinforce herself. Every time Anne answered a question, she was prompted to actuate a button on a mechanical counter on her tray. After a while, Anne was thus able to count all of her answers. The teachers also noticed that Anne occasionally counted her answers to questions asked her by her peers and other acquaintances. Once she learned to count, Anne's answers to her peers' and to other adults' questions became quicker and more consistent.

Strategy: Teach to Solicit Reinforcement

One may teach the student to follow the target behavior with an additional behavior that will normally elicit social approval. This strategy is one method of altering the reinforcement density and delivery in the generalization situation without overtly or directly changing staff behavior.

Solution, Example 8. Jay could be taught to say “I'm done” or “What's next?” or to turn and smile at the supervisor once he has finished the dishes. Such behavior should evoke attention that may serve to reinforce dishwashing behavior in the generalization situation.

Strategy: Reinforce Generalized Behavior

In training, generalized or adapted responses, or responses which occur in new, untrained situations are reinforced. When a response form is repeated, or performed a second time in the same situation, it is not reinforced.

Problem and Solution, Example 11. Susan's teachers are trying to teach her to play with other students during recess. Once Susan has played successfully with one student, she doesn't even approach other students. Of course, the natural reinforcer here should be that the play itself is fun. But, if Susan doesn't ever approach other students, she won't discover this. In order to teach Susan that playing with other students can be fun, the teachers decided to give Susan a

token whenever she approaches another student for a play activity. Susan can spend the tokens to "rent" the toys of her choice. Susan only earns a token when she approaches a child whom she has not approached before. Approaching previous playmates does not qualify for reinforcement. The strategy is evaluated by determining if initiations to new playmates improves, and, if it does, the tokens will be gradually faded.

Strategy: Alter Generalization Contingencies

One may ask people (or train them, if necessary) in the generalization situation to reinforce the target behavior appropriately, and/or on a particular schedule.

Problem and Solution, Example 13. Walker (1986) observed the playground behavior of fifth and sixth graders. Next, in a classroom situation, they trained emotionally disturbed students of the same age specific and appropriate playground social behavior, especially initiations. During training, they used the natural social interchange identified in their observations to reinforce the initiations and to signal subsequent appropriate behaviors.

Once their students met aim, they ventured onto the playground. Although the students perfectly generalized the trained social behavior, their fifth and sixth grade contemporaries met those behaviors with scorn, ridicule, or by ignoring the overtures. In short, the fifth and sixth graders treated the behavior displayed by the emotionally disturbed students differently than they treated those same behaviors when displayed by their peers.

One possible solution to this problem is to provide some form of training to the fifth and sixth graders or to selected leaders of those groups with the intention of modifying their current reactions to the emotionally disturbed youth. Once contingencies have been altered in the generalization situation, one must probe generalization in other situations if such generalization is desired. For example, if selected leaders were trained to contingently reinforce social behavior, one could probe the student's generalization to other "untrained" students.

Discrimination Function Problem

In this particular category of generalization strategies, we are concerned with the function of the events that occur before or during responding. These events evoke a particular response which will then result in reinforcement. The process by which the student learns to respond to these antecedent events in a particular situation is called discrimination learning. The following terms will be useful in our discussion.

Setting Events include the constellation of factors which generally "set the stage" for a large class of responses. For example, a restaurant sets the stage for the class of "restaurant behaviors," such as ordering and eating food, conversation with friends, paying the check, and so forth. It also eliminates other classes of behavior, which are usually not performed in restaurants, like "playground behaviors" (e.g.. running, screaming, kicking a ball). Some behaviors, with certain modifications, are appropriate in many settings, like talking. In any case, setting events are thought to represent any and all stimulus events in a particular situation. Whether a specific behavior occurs or does not occur, however, is more precisely evoked by specific stimuli associated with the response — the discriminative stimuli.

Discriminative Stimuli are environmental events that occur prior to or during the response and in whose presence the behavior is either reinforced or punished (S+) or in whose presence the behavior is neither reinforced or punished (S-).

A **Positive Stimulus (S+)** is the discriminative stimulus (**SD**) in the presence of which a specific response is likely to be either reinforced or punished (see Table 4 for examples).

A **Negative Stimulus (S-)** is the discriminative stimulus (**SD**) in the presence of which a specific response is neither reinforced or punished (see Table 4 for examples).

Discrimination-Learning is the process by which the behaver learns that responding with a particular behavior in the presence of the S+ will most likely be reinforced or punished (depending on the schedule of reinforcement) and that responding with that same behavior in the presence of the S- will not be reinforced or punished.

Discrimination learning is a critical component of acquisition — the student must learn the conditions under which the response will be reinforced and the conditions under which the response will not be reinforced.

In a chain of responses, each step functions both as a discriminative stimulus for the next response in the chain and as conditioned reinforcement for the response that preceded the stimulus change (see Table 5).

Irrelevant Stimuli (**Si**) are those that may or may not be present before and/or during responding (concurrent with S+'s and S-'s) but whose presence is actually not related to reinforcement or punishment (see Table 4 for examples).

These stimuli play an important role in the acquisition of a skill. In addition to discriminative stimuli, irrelevant events may interfere with generalization. When supposedly irrelevant stimuli are paired with S+'s and S-'s, they may come to control the behavior. For example, if a specific teacher or manager (Si) becomes associated with a response (a S+), the student will only perform the behavior for the teacher. The student who will answer his teacher but not his peers may be influenced by training in which his teacher taught him to answer her. In this case, the teacher or instructional manager (who should be irrelevant to answering questions) actually controls answering. The response occurs when the teacher or manager is present and does not occur when she is absent — the response is controlled by a stimulus which should be irrelevant to the response.

Table 4: Examples of S+, S-, and Si

Discriminative Stimuli	Irrelevant Stimuli	Response
Example I		
(S+) screw to be tightened	(Si) numbr of threads	pickup scrwdriver
(S-) nut on bolt	(Si) color of screw	
(S-) screw tightened		
Example II		
(S+) checkout clerk says amount owed	(Si) age of clerk	give clerk money
(S-) checkout clerk asks for identification	(Si) sex of clerk	
(S-) checkout clerk asks price of specific item	(Si) amount of money	
(S-) checkout clerk says, "Have a nice day."		
Example III		
(S+) agreeable food + hunger + location where eating is acceptable	(Si) name of restaurant	eat food
(S-) inedible food	(Si) time of day	
(S-) not hungry	(Si) color of plates	
(S-) library/church service		

Discriminative Stimuli	Irrelevant Stimuli	Response
Example IV		
(S+) desire to walk someplace + ok lime to walk there + Ok place to walk	(Si) color of clothing (Si) name of companion	Walks
(S-) no place to go		
(S-) too tired		
(S-) unsafe weather		
(S-) inappropriate place to walk ("No Trespassing")		
(S-) inappropriate time to walk ("Please wait for the next available clerk")		
Example V		
(S+) dirty carpet	(Si) color of carpet	vacuums carpet
(S-) clean carpet	(Si) make of vacuum	
(S-) uncarpeted floor	(Si) size of carpet	
(S-) grass		
Example VI		
(S+) Verbal request for 3, and 3 are available	(Si) object asked for (Si) color of objects	gets 3 ("concept of three")
(S-) Verbal request for another number of objects	(Si) person requesting	

In order for generalization to occur, students need to learn to discriminate the stimuli which occur in the generalization situations as "triggers" for the behavior they have learned. Generalization problems may occur when (a) discrimination learning has been so successful that any difference between the trained S+'s and those that occur in the generalization situation is sufficient to signal an S- situation (so the student does not respond); (b) discrimination learning has failed to establish control by the naturally occurring S+'s and S-'s; or (c) discrimination learning has failed to establish Si's as irrelevant (i.e., they act as S+'s or S-'s).

Strategies for solving generalization problems related to discrimination are described in the following sections. Additional examples may be found in the articles listed in the bibliography at the end of this chapter.

Table 5: Functions of Events/Responses in an Operant Chain
(adapted from Bellamy, Horner et al., 1979)

Event	Function
screw on table hole empty	S+ for response: place Screw in bole
screw in hole	Conditioned reinforcer for response of place-screw in hole AND S+ for response: pick-up-screwdriver
screwdriver in hand	Conditioned reinforcer for response of picking-up-screwdriver AND S+ for place-screwdriver-nose-in-screw-head-slot
screwdriver in screw	Conditioned reinforcer for response of placing-of-screwdriver-nose in screw-head slot AND S+ for response of rotating-head-clockwise

Event	Function
screw tight	Conditioned reinforcer for response of rotating-clockwise AND S+ for response of putting-screwdriver-on-table.
screwdriver on table	Conditioned reinforcer for response of putting-screwdriver-down AND S+ for next task or conditioned reinforcer for finishing task.

Problem, Example 14. Down the hall from Mel, Joanne, and Tim's high school classroom is a vending machine which dispenses a variety of snack items. One of their teachers, Mr. Ferd, decided that this would be a handy machine to use in training those students to purchase food and beverages from machines located in various community sites. After training, all three students were able to operate that machine rapidly, without errors, and without any prompts from him. To find out whether his students were able to purchase items in locations where high school students normally use vending machines, Mr. Ferd conducted generalization probes on 10 machines — another one in the high school, the machines in a video game arcade, a hospital lobby, a Laundromat, a movie theater, and a lunchroom in the local courthouse. He found, to his dismay, that none of the students were able to perform the skills which would allow them to purchase items from more than one of the untrained machines. On some machines, the students could not find the coin slot; on other machines, they inserted the coin, but did not make a selection.

Problem, Example 15. Prior to training, Lorraine did not greet people or respond to greetings in the usual socially acceptable manner. Instead, she would immediately begin telling a story, or asking questions, or she would simply ignore a friendly “Good Morning” or “Hi.” A program was then instituted to teach Lorraine to greet people, and to respond appropriately to the greetings of others.

It wasn't long, however, until the teacher received a call from Lorraine's mother, who was unhappy (to say the least) with the results of the program. It seems that Lorraine ignores her mother's “Good morning,” but now greets or will enthusiastically respond to greetings from just about everyone she sees who says “hi” or “hello,” including strangers and people that she has just seen a few minutes earlier. Her mother considers this an embarrassing and potentially dangerous outcome.

Problem, Example 16. Paul is learning to pick things up. As a start, the teacher uses toys in his instructional program because (a) toys possess characteristics which might act as natural reinforcers and (b) Paul has demonstrated an interest in a variety of toys by visually attending to them. The teacher selects a wide number of toys, which vary according to the S+ characteristics relevant to the response, and a wide number of objects as exemplars of the S- characteristics.

Once training has been completed, however, she is disappointed to see that Paul rarely picks up objects.

She decides to make a list of the objects that Paul picks up and those he doesn't. After much puzzling, she realizes that Paul only picks up objects that are red, or at least predominantly red. She looks again at the objects she has trained, and discovers that all of the toys she has selected are at least partially red!

Problem, Example 17. Ms. Olson takes Penny and several other class members to the McDonald's near the school twice a week to teach the chain of skills necessary to purchase food in fast food restaurants. On the other 3 days of the week, instruction is provided in the classroom using a realistic McDonald's simulation the teacher has devised. Penny seems to love to be able to purchase her own lunch and acquires the behavioral sequence quite rapidly. Since Penny is nonverbal, she learns to use a packet of photographs of food to place her order. Once the clerk has

rung up her order on the cash register, Penny hands dollar bills one at a time to the clerk, until the clerk stops taking the money. Penny then waits quietly until the clerk pushes a filled tray toward her, takes the tray, and goes to the condiment stand.

Ms. Olson reports to Penny's dad that she can order in a fast food restaurant. He takes her to Hank's Hamburgers. Penny selects the items she wants from her photographs and shows them to the counterperson, who takes her order and enters it in the cash register. Penny tries to give the clerk money like she does at McDonald's. But instead of taking the money, the clerk puts a receipt on a tray and slides it down the counter. At Hank's. another clerk will read the receipt and fill the tray and then a third clerk, at the far end of the counter, will accept cash and give the filled tray to the customer. The first clerk sees Penny's confusion, and tried to direct her down the counter, but Penny, still clutching her dollar bills, squats down on her heels and begins to rock — her usual response when she is confused and upset.

Problem, Example 14. Cheryl has just finished her vocational training program at Martin Luther King High School. Cheryl and three of her classmates have been trained to work as an industrial janitorial team. Today her team has been assigned to clean one floor of a local medical-dental building regularly serviced by Furham Sheltered Industries. The supervisor is evaluating the team for possible after-school employment. One of Cheryl's primary responsibilities is washing floors. She confidently begins work. Of course, she hasn't seen these particular floors before, or the mop, buckets, and detergent, but she does a thorough job. The supervisor is quite upset, however, when he sees that Cheryl has washed the floor of an office with wall-to-wall carpeting.

A closer look at our examples will illustrate each of the kinds of problems that can occur if there is a discrimination function problem. First, problems can occur if discrimination learning has been "too successful." Key stimuli (S+) for vending machine operation include: how the cost per item is displayed; location of displayed cost; location of coin slot; amount of item; item activator; whether item is visible; type of product; and coin return slot. Mel, Joanne, and Tim learned these stimuli on a single vending machine. When the stimulus features were different on the probe machines, they could not generalize the skills. They had learned to look for a knob as the S+ for item selection. When this S+ feature differed (e.g., when a button was the S+ for item selection instead of the knob they had learned), generalization did not occur.

The same type of problem befell Penny. She had learned to pay the person taking her order. When this stimulus did not lead to the consequences she expected, her behavior deteriorated. In both of these situations, the instructed S+'s which controlled behavior differed significantly from the generalized S+'s, and the student discriminated the difference and responded to the untrained S+'s as if they were S-'s or Si's.

Second, generalization problems may occur when critical stimuli are omitted from the training situation. For example, Cheryl's vocational training instructor failed to teach a very significant S- for floor washing — wall-to-wall carpeting. In this case, although Cheryl successfully discriminated all of the steps involved in floor-washing, the teacher did not teach Cheryl that certain floors are to be washed while others are not.

Paul's responding came under the control of irrelevant stimuli. All of the objects used in training shared the characteristic of red coloring. In this situation, the irrelevant stimulus — a red color — has come to control responding. Paul picks up objects that are red and doesn't pick up objects that are not red. Although irrelevant, the red color is acting as an S+ while "not-red" is acting as an S-.

Strategy: Vary Stimuli

To remediate discriminative function problems, institute training in which you systematically introduce and vary stimuli which occur in the generalization situation.

Analyze all of the instructional events/stimuli (i.e.. what you taught) against all of the generalization stimuli in order to identify, for each class of stimuli, those that are necessary for proper generalization. If you can guess which stimuli are causing the problem, you will reduce the training time, although stimulus control problems often involve more than one stimulus. Then, you must reinstate training in which behaviors that follow specific "poor" discriminations are not reinforced and behaviors that follow stimuli which should control responding are reinforced. Strategies which are effective in discrimination training may be useful here (see Haring, Liberty et al., 1981; Liberty, 1985; Snell, 1987).

Whatever strategy is selected, all of the S+'s are introduced and followed by reinforcement, and all of the S-'s are introduced and any target behaviors which follow are ignored (i.e., not reinforced). All of the Si's are also introduced, paired with the S+'s in some cases and with the S-'s in other cases. Irrelevant stimuli should be varied across S+'s and S-'s. The variation of stimuli must be systematic and thorough.

There are four basic methods for determining how to select stimuli for this intervention.

All stimuli. It would be ideal if all possible stimulus events could be included in training.

For example, if you are teaching a student to pick up coins, and if the S+ of coin size is a problem, it would be possible and practical to teach *all* coins, but it will usually *not* be possible to train all stimulus events. For example, there would be no way to include all possible S+'s in a "pickup *objects*" program. There are just too many different types of objects.

Frequent stimuli. Survey the generalization situations and identify all of the stimuli for each class, or for the class you think is causing the problem. Then, pick those stimuli that occur most often or most usually across generalization situations.

Multiple exemplars. Survey the generalization situations and identify stimuli which are examples of stimuli (i.e., exemplars) and which represent the range of events the student might encounter. This method is suitable when it is not possible to identify all possible events, as in the S+'s for the pick-up program. You will know that you have included "sufficient" exemplars when your probes for generalization meet with success.

General case exemplars. Identify the group of stimuli or situations across which generalization is desired. That group is known as the instructional universe (Sprague and Horner, 1984). Then, identify the range of stimulus and response variation that exists within that universe, and teach the minimum number of examples that sample the complete range of stimulus and response variation.

The objective is to select a logistically feasible set of examples that sample the relevant stimulus variation in situations that the student will encounter after training. When selecting examples, begin by looking at each response that the student is to learn. For each response, define the stimulus that should exert control. Then examine how that controlling stimulus changes across the different stimulus conditions within the predefined instructional universe (Horner, McDonnell et al., 1986).

Criteria for selecting examples are shown in Table 6. This approach is based on the premise that generalization will be most successfully achieved when individuals are exposed, during training, to exemplars of the stimuli and responses which are associated with task performance across all targeted situations and materials.

Table 6: Selecting and Teaching Examples for General Case Instruction
(adapted from Horner, McDonnell et al., 1986)

Selecting Examples

1. The set of positive examples should be similar only with respect to relevant stimuli (S+). Irrelevant stimuli (Si) should be as different as possible across examples.
2. The set of positive examples should sample the range of stimulus variation across which the learner is expected to respond (i.e., across the instructional universe).
3. A range of negative examples (S-) should be included (where appropriate) that are maximally similar to positive examples (e.g., when teaching the generalized skill of busing cafeteria and restaurant tables, the set of teaching examples should include tables that should not he bused.
4. Select a set of positive examples that included significant exceptions (e.g., for generalized street crossing, cars that pull away from curbs or out of driveways are "exceptions" that need to be taught).

Teaching Examples

1. Teach multiple components of an activity or skill within each training session. With simple skills (e.g., tooth brushing), teach all the behaviors within each session; with more complex skills, such as assembling circuit boards, teach portions of the skill that include multiple components rather than teaching a single component.
2. When the whole skill or activity is taught, use multiple examples within individual training sessions. Do not train one example at a time in an easy-to-hard sequence. While the learner experiences more success with an easy-to-hard sequence, she or he also learns generalization errors that decrease the efficiency of instruction and limit the utility of the acquired behavior. When presenting multiple examples of varying difficulty, however, it is reasonable to present a mix of 60% easy examples, 20% intermediate examples, and 20% hard examples within a session. This allows the student the opportunity to succeed with easy examples yet experience the full range of variation needed to prevent generalization errors.
3. Present maximally similar positive and negative examples one right after the other. This is especially important for behaviors in which learning when (or where) *not* to perform the behavior (S-) is as important as learning when (or where) to perform the behavior (S+). This sequencing technique teaches the learner the specific stimuli that define the limits within which the target behavior is appropriate.
4. Review examples learned during previous sessions. When many examples are being taught, instructional sequences should include some new and some "old" examples during each training session.
5. Teach the general case before teaching exceptions.

Solution, Example 14. Each of these strategies could be applied to identify stimuli to teach vending machine use. To teach all of the possible variations in stimuli, Mr. Ferd would have to teach his students how to operate all of the vending machines around. He decided that this would be impossible.

The "frequent stimuli" strategy, as well as the other strategies, should be applied first to the S+, S-, or Si that you suspect may be causing the problem. Mr. Ferd thinks the location of the item cost (an S+) might be the problem area. In order to determine what "cost location" stimuli to train, he could first survey all of the machines that he thinks his students might use (i.e., frequent stimuli) and identify the kinds that occur most often. If, for example, costs are usually displayed right above the item or right below the item, he would choose machines for training which display the costs that way.

To use the "multiple exemplars" strategy, Mr. Ferd would include one machine that displayed cost above the item, one which displayed cost below item, one where cost is displayed next to item, one where cost is listed on panel below coin slot, and so on.

To apply a "general case" approach, Mr. Ferd would survey all of the vending machines he could, and identify stimulus groups with common characteristics for each stimulus event. He would then teach at least one example from each group so that the entire range of variation is sampled in the training. For example, at least one of each of the following would be included: cost displayed above item, cost displayed below item, cost displayed next to item, cost listed on panel below coin slot. This stimulus (i.e., cost location) would be systematically varied in a constellation with other S+ events (e.g., item viewing location, item choice activator, location of coin slot. amount/cost of item, etc.) (see Table 7).

In this example, the site of training (i.e., setting event) would be determined by several considerations. If Mr. Ferd can arrange to borrow the vending machines he needs, he can conduct his training in the school. Companies which distribute and operate vending machines may be willing to loan them to the school. However, if he cannot arrange for the vending machines to be available, he could conduct training where the vending machines are located. If training "on-site" can't be arranged, he may have to use vending machines that are available in the school or construct simulated vending machines. In any case, probes to untrained machines in other settings would need to be conducted.

Table 7: General Case Analysis Form (Horner, Sprague et al., 1982)

Student: **Activity:** Vending machine use
Teacher: **Instructional Universe:** All machines in Eugene, OR

Generic Responses	**Generic Stimuli and Relevant Characteristics**	**Relevant Stimulus Variation**	**Relevant Response Variation**	**Exceptions / Potential Errors**
1. Select coins	1.1 Displayed cost			
	a. Location	By coin slot; 18 in. to left of item; above item; beside item; below item	Pull coins from pocket or purse	Other symbols of similar type, size, and location on machine
	b. Amount	20¢-75¢ in units of 5¢	Select 1, 2, or 3 quarters	"Out of order" sign
2. Insert coins	2.1 Coins in hand	1, 2, or 3 quarters	Insert 1, 2, or 3 quarters	Other people using the machine
	2.2 Coin slot in machine			
	a. Location b. Orientation	Right or left side	—	The "exact change" and "all out" indicators look similar and are located similarly to the coin slot
3. Activate machine	3.1 Coins in machine	All coins in machine	—	—
	3.2 Item activator	Button; slide door; panel; lever	Push button; slide door; push panel; pull lever	Variation in umber of buttons; variation in array of activators
	3.3 Item discriminator	Words; actual item; logo code; letters	–	Red light on selector

Generic Responses	Generic Stimuli and Relevant Characteristics	Relevant Stimulus Variation	Relevant Response Variation	Exceptions / Potential Errors
4. Obtain item	4.1 Item visible	Liquid in cup; actual item; item in chute; item drops	Grasp item; lift door with one hand and grasp item with other; push door with one hand and grasp item with other; lift cup of liquid	—
	4.2 Noise from dispenser	Item drops; noise stops	—	—
5. Check for change	5.1 Product in hand	Cup; can; packaged item	—	Bottle cap remover looks like coin return on soda machines
	5.2 Coin return slot	Right or left side; with or without door; 1.5 to 2 feet high	Place finger in slot, push small door back	—

Solution, Example 15. Lorraine's teacher identified the following groups of stimulus events:

S+: Greetings (words, phrases, gestures);
Recognition of person who has not been recently greeted;
Activity that can been interrupted to greet someone.

S-: Not a greeting statement ("See you later," any command. etc.);
Unknown person;
Person previously and recently greeted;
Activity which should not be interrupted to greet someone (e.g., work).

Si: Time of day;
Clothing worn by the greeter;
Setting where greeted (except as noted).

For our example, let us look at the types of specific stimuli identified for the S+, "Greetings."

For a frequent stimuli approach, the teacher would first write down all of the greetings that she observes in sample observations in the school and the community. She would then select the greetings that occur most often — for example, "Hi," "Hello there," "Good morning," "Hi, (name)," and "Say, (name)" — and train Lorraine to respond to them. Generalization probes (see White, 1988) would include untrained greetings.

To use the multiple exemplar approach, Lorraine's teacher would select several different greetings and teach them. If Lorraine did generalize to untrained greetings, the number of exemplars selected would have been "sufficient" to produce generalization. Unfortunately, there are no empirically derived methods for determining how many are "sufficient" without actually testing them.

The general case requires steps in addition to observing and recording greetings. Greetings are classified according to different characteristics or components, such as the number of words in the greeting, whether the person's name is included, interrogative case or not, time of

day delivered, and resemblance to S- characteristics (e.g., “Good morning,” an S+, is similar to “Good bye,” which is an S- for greeting and an S+ for farewell). The teacher would include representatives of each combination of characteristics in this approach.

Solution, Example 16. Paul's teacher decides to vary the irrelevant stimuli. The color (Si) of both the S+ ands the S- objects will have to be varied so that a particular color or color combination does not come to act as either an S+ or as an S-.

But what S+ and S- stimuli should she choose to represent the Si in training? Obviously, she can't possibly include all of the colors and color combinations that Paul will encounter. In order to include frequent stimuli, the teacher would survey all of the toys and other objects in Paul's current environent and note their colors and color combinations. Colors/combinations that occur most frequently would be trained.

The multiple exemplar approach would not necessarily include all “common stimuli,” but should encompass a wide variety of colors/combinations.

In addition to a survey of all of the toys and other objects in Paul's current and subsequent environments, the Si colors would be classified (e.g., bright colors, subtle colors, monocolored, multicolored, patterned, changeable colors like doll clothing, semitransparent colors), and training would include at least one example of each.

Solution, Example 17. Ms. Olson surveys the fast food restaurants in Penny's community and identifies the different “order-pay-get served” options. These include:

(a) order, pay. receive food from one clerk at Counter (McDonald's, Burger King, Wendy's);

(b) order and pay one clerk, get beverage from second clerk, wait to be called for food, pick up food at third location on counter (Flakey Jake's, Shakey's Pizza);

(c) order and pay one clerk, wait until number is called, get beverage and food from second clerk (Kidd Valley Hamburger, Hoagy's Deli);

(d) order food from one clerk, order beverage from second clerk, pay second clerk, wait, get food from second clerk (Ivar's Fish Bar);

(e) order, pay, wait, get food from same clerk (Dick's Drive In, where you can walk-in);

(f) take number, wait until number called, order, get served, pay (Baskin & Robbins, Schumacher's);

(g) order from one clerk, move down counter while second clerk fills order, pay and receive food from third clerk (Hank's).

For the frequent stimuli method, she would teach the chains that occur most often in the community or the ones that Penny currently favors. For the multiple exemplar method, she would teach several different sequences. For the general case method, she would teach one example of each of the different classifications identified.

Solution, Example 18. One of the sets of stimuli that Cheryl must learn is the set of all S-’s for floor-washing. These include:

(a) hardwood floors or any bare wood floor;

(b) floors with wall-to-wall carpeting;

(c) floors with area rugs (ask whether rugs should be moved, be washed around, or not be washed);

(d) stone/slate/brick floors that require special treatment.

For each of these classifications, there are many different stimuli that could serve as examples. Under the frequent stimuli method, the teacher would include stimuli that occur most frequently in the floors Cheryl would be most likely to clean. With the multiple exemplar method, the teacher would include several different stimuli from each classification. With the general case method, the teacher would include at least one from each class of the S- stimuli, in combinations of characteristics.

Generalization Format Problem

If you have followed the rules correctly, and you have eliminated the other problems, we suspect that there may be a combination of factors inhibiting generalization. To help you identify potential change strategies, first check that your instruction has included these basic format considerations introduced in the previous sections of this chapter:

1. *Proficient aim*. The aim set for the target response should ensure that the target response is the most efficient means of acquiring the reinforcer (see *Strategy: Increase Proficiency*, page 7).
2. *Natural reinforcers*. The reinforcers which control responding in training are identical to those which are available to control responding in the generalization situation (see *Strategy: Program Natural Reinforcers*, page 10).
3. *Natural schedules*. Schedule of reinforcement used in training matches the naturally occurring schedule in the generalization situations (see *Strategy: Reinforce at Natural Schedules*, page 12).
4. *Appropriate natural stimuli*. The S+, S-, Si, and setting events have been carefully selected and all have been systematically included in instruction (see *Strategy: Vary Stimuli*, page 22).

If you feel that your format meets these basic considerations, the following intervention may also be useful.

Strategy: Eliminate Training Stimuli

Eliminate all of the stimuli used in instruction which are not available in the generalization situation. Most often, these are events which are functionally irrelevant to the response (Si), but are used to facilitate acquisition and/or fluency-building. A discussion of the function of stimulus events begins on p.22.

For example, while there might be a huge variety in the types of stimuli associated with eating, they generally include a place where food is available (setting event), a desire to eat the food that is available, and specific food items (S+). These are the natural stimuli that are associated with eating.

During acquisition of eating behavior, however, the instructor may cut food in bite-sized pieces, verbally direct each bite (e.g., "Take a bite"), and schedule instruction to occur at a time when the student may not be hungry. Each of these stimuli (i.e., bite-sized pieces, verbal cue, and absence of hunger) is not usually associated with the response, but, since it is associated with reinforcement during training, it may come to control responding. For example, the cue "Take a bite" may come to control responding. When that cue is not given, student may not eat.

Commonly used teaching events include verbal directions, demonstrations, prompts, massed trials, and so on. These events may be defined only through comparison with the events which precede the response in natural, nontraining situations. In addition, the classification of

events may be related to the age of the behaver. For example, verbal directions to "Go to bed" may be natural with youngsters, but not natural with adults. Some examples are shown in Table 8.

Table 8: Examples of Training Stimuli

Example I: Desired Behavior = Head Up	
Stimuli	**Type**
Activity in classroom	Natural S+
Teacher verbally cues "Head up"	Synthetic S+ used for training
Example II: Desired Behavior = Dresses Self	
Stimuli	**Type**
Shortly after waking; before and after PE; before and after swimming; before and after special event	Natural S+
Dressing occurs at 10 am daily, regardless of necessity of changing clothes	Synthetic S+ Natural S-
Puts shirt over bare chest or undershirt	Natural S+
Puts shirt over other shirt	Synthetic S+ Natural S-
Privacy	Natural S+
Lots of people around	Synthetic S+ Natural S-

Stimulus control exerted by teaching events can be avoided or eliminated by (a) varying the type of teaching event used during acquisition, (b) probing often to determine if performance can occur without the event, and, if it can, dropping the use of that event immediately, and (c) gradually reducing the intensity, severity, or degree of event used (e.g., reduce verbal prompts from normal tone of voice to a whisper and then eliminate completely).

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