Chapter 3

Review of Behavioral Principles

In this chapter the goal is to outline certain behavioral principles and give basic background information about behaviorism to help the reader better understand what guides our thinking about treatment. We will cover respondent conditioning, operant conditioning, social learning, and new information on derived relational responding. We also provide an outline of applied behavior analysis which is the guiding therapeutic method that we use to progress a child's development.

Classical Learning

Sensory inputs from the external world have either excitatory or inhibitory effects on the central nervous system. Homeostatic equilibrium of the central nervous system is the result of interplay between reflexive excitatory and inhibitory effects of the incoming sensory information. The central nervous system collects and organizes the incoming information and respondent conditioning (classical learning) is the most basic process of integrating the information from the external world (Pavlov, 1927/1960). Classical conditioning also known as respondent conditioning is referred to here as classical learning.

Classical learning is stimulus-stimulus pairing. An unconditioned stimulus evokes reflexive autonomic reactions in an organism. If a stimulus that does not cause the autonomic reaction (S) is paired with a stimulus that does (UCS) it becomes a conditioned stimulus (CS). In other words a stimulus that did not evoke a reflexive autonomic response now evokes the reflexive autonomic response as a result of being paired with a stimulus that did originally cause the response. Speaking in this way makes

it difficult to understand how to use the principles of classical learning in every day life. For that reason we will provide some heuristic explanatory fictions to help people understand how classical learning can be used in day to day life.

Classical learning (Conditioning) allows an individual to predict the occurrence of environmental events based on an earlier cue from the environment. Children will often associate certain activities with certain therapists and request the activity every time the child see's the therapist. Here the child sees or hears the therapist (environmental cue) and anticipates certain behaviors and activities from the therapist. As the child anticipates a connection between environmental events, certain environmental cues, like the therapists appearance, begin to take on the emotional characteristics of what that environmental cue predicts. If the therapist does not initiate the behavior expected the child will often try to communicate with the therapist by whatever means possible to inform the therapist about what they expected. The ability to change behavior based on consequences will be described later as learning by consequences. Through classical learning the child learns to associate certain environmental events. When the phone rings mom walks to the phone. When the dinner bell rings food is often on the table.

Children learn to predict what will happen next based on the perceptual cues they experience. If the result of the prediction is better than the child expected, excitatory learning takes place (Resorla, 1968). As excitatory learning takes place the early cue (environmental event) takes on the stimulus qualities of the predicted event. What do we mean by "Takes on the stimulus qualities"? Suppose a child hears the sweet sound of bells and music coming down the street. Every time after hearing these sounds an ice cream truck pulls up and the child gets an ice cream bar. The ice cream bar has the

stimulus quality of evoking salivation. When the music is associated with the child receiving an ice cream bar the music takes on the stimulus qualities of the ice cream bar. In other words the music evokes salivation. The music will also come to evoke other autonomic responses such as a feeling of excitement in the stomach, shaky limbs or an increased heart rate. These autonomic responses are usually referred to as emotions and are the basis for what people talk about as emotional intelligence. What is actually occurring is basic classical learning and learning by consequences which are outside of the realm of verbal behavior. Since classical learning and learning by consequences do not rely on language to be effective the most salient concomitant experience people have is their experience of emotions. When a person behaves in a certain fashion without the ability to put into words why they behaved as they did their behavior falls within the area of emotional intelligence.

As mentioned earlier children learn to predict what will happen next based on the perceptual cues they experience. If what is predicted is better than the child expected, excitatory learning takes place. If the cue overestimates the result, inhibitory learning takes place and the process of extinction begins (Resorla, 1968). In other words when an earlier cue (environmental event) usually predicts a big payoff but this time you only get a small payoff you learn that the environmental event did not predict the big payoff. Because the cue did not accurately predicting the result you learn that the result will not occur to the magnitude you want when that cue is available and the cue does not take on the stimulus qualities of the predicted event. The cue may take on negative emotional stimulus qualities resulting from the under prediction. If the music does not consistently predict ice cream bars the music will not evoke salivation, or heightened positive

emotions. If the music used to predict ice cream bars but now ice cream bars never follow the music, the music may produce negative emotions. Finally, if the result of the prediction is as expected no learning takes place (Resorla, 1968).

Excitatory learning involves the cue accurately predicting the second environmental event. The child learns that when one event occurs, the second event always follows. The child has learned a predictive relationship between two events. If the expectation is disconfirmed because the second environmental event didn't occur as expected extinction of the predictive relationship will begin. The child will no longer believe that the second event is going to happen after the first. Associated with this predictive ability are negative and positive emotional states driven first by the stimulus qualities of the predicted event and secondarily by the history of negative and positive predictive experiences generated around the stimuli. For example, the process of extinction usually evokes the emotional experience of anger or rage.

The behavior of a child can roughly be divided into behavior that is voluntary and behavior that is involuntary or reflexive. Voluntary behavior is very goal directed and is strongly influenced by what occurs after the behavior or in other words the consequence of the behavior. Involuntary behavior is evoked by environmental events causing sensory stimulation which results in reflexive behavior, emotions and physiological reactions. Some environmental events naturally cause reflexive behavior such as orienting to the environmental event, emotional reactions and physiological responses. For example suppose you are hungry and you walk into a room with the aroma of you favorite food. You will likely begin to salivate. Or suppose you walked into a room and someone came in right after you and fired a couple of rounds from a shot gun. In this case you heart will

most likely start to race. These are both reflexive responses. Events in the world that do not ordinarily cause behavioral reflexes, emotional and physiological responses can start to cause these effects if they are predictive of an event in the world that automatically causes the reaction. So if a someone yells he has a gun immediately before someone comes in and starts shooting the sound of someone yelling "he has a gun" after coming before the gun shots will cause the same reaction as hearing the gun fire later even if no gun fire is present. This is basic classical learning.

A final important principle from classical learning involves the process of reciprocal inhibition. The theory of reciprocal inhibition suggests that two opposite emotional states can not exist simultaneously (Wolpe, 1958). This principle can also apply to behaviors and physiological reactions. You can not run and stand still at the same time or sweat and not sweat.

Classical learning has many practical implications for the treatment of children with autism. Children who have anxiety reactions can, through the process of reciprocal inhibition, become comfortable with the environmental events that caused the anxiety reaction. The aversive environmental event can become predictive of an event that causes an incompatible response resulting in a decrease of the aversion to the previously aversive event. At a basic level classical learning suggests that a child can be comforted by increasing the predictability of their world. Physiological, emotional and behavioral instability can be stabilized by implementing routines and by adding structure and consistency to their lives. A child does not have to be continuously affected by the environment in a distressing way. An understanding of how environmental events relate

to one another provides us with tools which allow us to change the child's reactions to the environment.

For example, suppose a child gets very anxious around crowds of people. The crowd, which is an environmental event, is resulting in the reflexive emotional response of *anxiety* (from a behavioral perspective the child is demonstrating anxious behaviors). If we can make the crowd a predictive environmental event for the attainment of fun and excitement, the child will no longer be *anxious*. When they experience crowds in the future they will anticipate the fun exciting event. The end result is that the crowd of people will no longer cause the same anxiety reaction in the child and the child will no longer exhibit anxious behaviors.

Learning by Consequences

Classical learning as just described mainly teaches a child to be able to predict what is going to happen in the world around them. A child gains control through the ability to predict how events in the world fit together. Classical learning also gives us a way to change how environmental events are experienced as well as a way to change reflexive behavior.

Learning by consequences (operant conditioning) allows a child not only to be able to predict what is going to happen from an event they experience but also to control what is going to happen through altering their own behavior. Behavior does not have to be reflexive and at the mercy of environmental triggering events. Behavior can be purposely emitted without perceived triggering events from the environment. A child can move out into the world and actively seek out environmental triggers.

Children and adults learn practical information about the world by interacting with the world, learning to predict what is going to happen, and changing their behavior based on previous results obtained when interacting with the world. The law of affect basically says that behavior that is successful at achieving its goal will occur more often and behavior that is not successful at achieving its goal will decrease (Catania, 1998).

Incentives to do things in the world can be categorized as intrinsic to the task and extrinsic to the task. Intrinsic tasks have positive and negative value built into the task. Working usually has some negative value and often people would quit working if it wasn't for the extrinsic incentive of receiving a pay check. Going mountain climbing for some people may be intrinsically rewarding and for others intrinsically aversive. Intrinsically motivated behavior is maintained by the natural pleasure a child receives from the activity. Extrinsic motivated behavior needs to be arranged by a parent, teacher or the larger society as a whole. In other words extrinsically motivated behavior is a social phenomenon.

Providing therapy to progress a developmentally delayed child can be much more enjoyable to the child if the therapist can take advantage of as much intrinsic motivation as possible. A flexible, clear, understanding of what is intrinsically and extrinsically motivating to the individual child is an important part of motivating the child to progress. Intrinsic motivational factors and activities should always be considered when extrinsic motivation is lacking and visa versa. Extrinsic and intrinsic motivations are usually considered to be controlled by states of deprivation and aversion. You are not motivated by extrinsic or intrinsic rewards if you are satiated with those rewards. The only way to

not be satiated is to not have access to them. Children do and say things in the world to get something they do not have or to escape from something they do not want.

Learned passivity can result when all good things come unrelated to contingent behaviors and instrumental effort just as learned helplessness can occur from aversive stimulation which is not contingent on behaviors. Children who are often exposed to punishment that is not contingent on their behavior become overly cautious and nervous. Dealing with and solving contingencies to achieve control over desired outcomes stabilizes a child's behavioral, emotional and physiological well being. The mind of a child who is not solving contingencies on a daily basis will be confused and chaotic and the child will appear to be out of touch with reality. Adding structure and a program designed to place contingencies before a child on a daily basis will lead a child to better contact with reality and feelings of confidence related to understanding and knowing how to control the world.

When trying to decide what will motivate a child to learn the therapist should always keep in mind the Premack Principle which states that behavior occurring at a high frequency can be used to increase the rate of behavior that occurs at a low frequency. Premack states that: "For any pair of responses, the independently more probable one will reinforce the less probable one" (Premack, 1962:255). For example, suppose a child likes to eat pie but does not like to eat vegetables. If the child has to eat vegetables before they can eat pie vegetable eating will increase. The Premack Principle is also called "grandma's law".

When a child with autism learns a new behavior, the behavioral response is tied to the context in which it was learned and it may not readily generalize to a new context or

environment. New tasks are learned more easily under familiar, consistent conditions. After a task is learned in a familiar consistent environment it should be moved to less familiar and more distracting locations. Plateaus in learning are often easily overcome by varying the teaching environment and methods.

Although the principles of classical learning and learning by consequences as described above are separated into two discrete learning processes, they both are occurring at all times. Classical learning leads to predictive relationships between environmental stimuli and effects and alters our reflexes, glandular responses, and emotions. Reinforcement in classical learning occurs when a preceding environmental event accurately predicates a subsequent environmental event. Adults and children, including children with autism, strive to predict and control their environment. Learning by consequences allows us not only to predict environmental events but also to change our behavior in order to optimize outcomes. When significant environmental events are adequately predicted and controlled the result is adaptive success and a feeling of calm confidence about the child's place in the world.

Learning by consequence (operant conditioning) involves a signal (previous environmental event) which is part of the context in which the behavior will occur. The signal (SD) says that desired outcomes are available in the environment and that efforts to solve the contingencies presented will lead to attainment of desired outcomes. If you solve the contingencies you will get what you desire. Second, we have the response (R), or the child's behavioral attempt at solving the contingency presented. Finally we have the outcome (O) which is whether the child is successful or not at solving the contingencies presented. If the child successfully solves the contingency he/she receives

the desired outcome. If the child doesn't solve the contingency the desired outcome does not occur. The desired outcome when it occurs strengthens the behavior that occurred to produce it and the stimulus qualities of the desired items become associated with the signal and other contextual environmental events that predicted the occurrence of the positive outcome.

Learning by consequence is an attempt to control the outcome. If a child controls the outcome better than they expected, the result is *pleasure* in attaining the desired outcome and *pleasure* resulting from being able to successfully control the world. As a result the behavior will occur more often. When a child does not control the outcome as much as they had predicted the behavior aimed at achieving the outcome will decrease. New strategies will be tried if the child has a history of successfully being able to problem solve contingencies and has learned that when one thing doesn't work try something else. This way of reacting to unsolved contingencies comes from facing many contingencies and having success solving many contingencies. Infants who have a history of successfully controlling stimulation are, later on in life, better able to understand the contingencies between their behaviors and environmental events (Finkelstein and Ramey, 1977). As a child learns that they can be faced with contingencies and successfully solve the contingencies *self-efficacy* and an *internal locus of control* develop.

Social Learning

Self-efficacy involves a child developing *expectancies* about future events based on a feeling that the child is personally capable of solving the contingencies presented (Bandura, 1977). An *internal locus of control* is a belief about what causes an outcome

(Rotter, 1966). If a child believes that outcomes occur regardless of their own behavior they are said to have an external locus of control. If a child believes that they can control the outcome they are said to have an internal locus of control. *Expectancies* of positive outcomes results in anticipatory *excitement* or *joy*. *Expectancies* of threat or harm result in *sadness* (Kirsch, 1990). The *expectancies* created through respondent and operant conditioning result in emotional changes in the child.

Motivation

All organisms including human beings interact with their environment based on states of need. States of need or states of motivation are mainly controlled through the incoming sensory neurons. A child experiences their environment and body through their senses. All physiological, behavioral and social processes try to maintain homeostasis. Every sense modality has a set point or a range of nervous stimulation that does not cause the organism to behave in their environment to achieve homeostasis. In other words if I am not cold I do not need to do anything to become warm and conversely if I am not warm I do not have to do anything to cool myself down. This set point is a state of lack of motivation. Any deviation from the set point will cause corresponding states of motivation to act which are proportional to the distance from the set point. It is much less likely that I will engage in behavior to become warm if I am only slightly cold. The colder I get the more likely it is that I will engage in behaviors that will lead to becoming warm.

Human beings are born with unlearned motivation built into the nervous system. These unlearned motivational states, in behavioral terms, are called Motivating Operations. There are unlearned (unconditioned) Motivating Operations and Learned

(conditioned) Motivating Operations. Unlearned Motivating Operations are all a product of homeostasis of the organism. Learned Motivating Operations become Motivating Operations by being paired with and predictive of Unlearned Motivating Operations mostly through the process of Classical Learning. Learned Motivating Operations are also acquired to some degree through the process of learning by consequences.

Each sense modality (sight, hearing, taste, smell, tactile, kinesthetic, vestibular, and deep tissue sensors) have a set point at which the organism is not motivated to act. In the process of achieving homeostasis as sensory stimulation decreases or increases from this set point corresponding behavior will occur to restore equilibrium and bring the sense modality back to the set point. This is the basis of unlearned motivation. When it is to bright behaviors will begin to decrease the brightness. When it is too dark behaviors will occur that increase the brightness. When a sound is too loud behavior will occur that will decrease the sound intensity. The most basic unlearned motivators are based on establishing equilibrium. It should be noted that Motivating Operations are aspects of the environment like the temperature of the room or the presence of a wild bear. The organism experiences the environmental conditions through the senses. The main Unlearned Motivating Operations are:

Set points of deep tissue senses involve hunger, thirst, carbon dioxide levels and sexual arousal. Food deprivation when in effect increases the value of food to the individual and makes all behaviors that have been successful in the past at attaining food more likely to occur. Excessive food satiation will decrease the value of food and increase all behaviors that have been successful at decreasing excessive satiation. Water deprivation when in effect increases the value of water to the individual and makes all

behaviors that have been successful in the past at attaining water more likely to happen. Sleep deprivation increases the value of sleep to the individual and increases all behaviors that have been successful at attaining sleep. Excessive levels of carbon dioxide will result in an increase value of oxygen and will increase all behaviors that have been successful at increasing oxygen levels.

Deprivation of visual stimulation will increase the value of visual sensation and increase all behaviors that have been successful at increasing visual input. Excessive visual stimulation will decrease the value of visual stimulation and increase all behaviors that have been successful at decreasing visual stimulation.

Deprivation of auditory stimulation will lead to an increased value of auditory stimulation and will evoke all behaviors that have been successful in the past at increasing auditory stimulation. Excessive auditory stimulation will lead to a decrease in value of auditory stimulation and there will be an increase in all behaviors that have been successful at decreasing auditory stimulation.

Deprivation of physical sensations will increase the value of physical sensations and increase the likelihood of all behaviors that have successfully resulted in physical sensations. Excessive physical sensation will decrease the value of physical sensations and there will be an increase in all behavior that has been successful at decreasing physical (tactile, warmth, cold, pain) sensations.

Learned (Conditioned) Motivating Operations achieve their motivation altering effect by pairing and prediction with Unlearned (Unconditioned) Motivating Operations. Most of what motivates us is learned. In today's society hunger, thirst, body temperature, and tactile sensations are often taken care of for a child by a care giver. One of the first

Learned Motivating Operations is social affiliation. Closeness with a caregiver is often paired with and predictive of equilibrium in regard to the senses described above. As a result social affiliation becomes one of the strongest Learned Motivating Operations.

Children with autism often have sensory issues. In other words their set point for equilibrium is different from the set point of most other people in their environment. This profoundly confounds our understanding of motivating factors in the child with autism's life. It might be difficult for a parent or caregiver to accurately asses the needs of the child. Accurate assessment is necessary to help the child regulate their sensory environment. Accurate assessment of a child's needs leads to paring of the caregiver with biologically determined motivational states and results in establishment of the caregiver and others as secondary or conditioned motivators.

A parent should also be very aware of how environmental events predict successfully establishing sensory equilibrium. Everything that predicts sensory equilibrium will be experienced by the child as a conditioned reinforcer.

Derived Relational Responding

It was mentioned above that research suggests that children can learn new tasks better in familiar, consistent conditions yet one of the main criticisms of the Lovaas approach is that we provide such familiar and consistent conditions that generalization of results will suffer. Some children need extreme consistency to learn and will not learn in a natural environment. If they could, they would be learning much more like a typically developing child. Usually a child with autism needs to originally be taught in a familiar and consistent environment. After a child is taught information in a structured familiar environment the information needs to be generalized into the natural environment.

Derived-stimulus-relations involve a child being able to respond to items and language that they have not specifically been taught. Derived-stimulus-relations involve reflexivity, symmetry and transitivity (Hayes, Barnes-Holmes, & Roche, 2001). Reflexivity involves matching identical items.

Given a picture of a dog a child will pick an identical picture of a dog.

Symmetry involves the reversibility of relations. If a child learns to point to a picture of a dog when shown a live dog the child will be able to point to a live dog when shown a picture of a dog without this response being specifically trained.

Child learns Picture of Dog = Live Dog child will also know that Live Dog = Picture of a Dog.

Transitivity suggests that if a child is taught to point to a picture of a Dog when shown a live Dog and then learns to Say Dog when they see a live Dog when shown a picture of a Dog the child will say Dog.

A child learns Picture of Dog = Live Dog and separately learns Live Dog = word "Dog". Transitivity suggest that the child will know spoken word "Dog" = Picture of Dog.

Notice that the three combine and the Picture of Dog leads to the saying Dog even though saying Dog to the picture of the dog has never been trained. Derived-stimulus-relations (knowing that a Picture of Dog = Spoken word Dog without being trained in this association) rely on the real physical qualities of the items for generalization. The child relies on what the object looks like or feels like. The child relies on a real physical quality of the item presented.

Children with autism often have difficulty with symmetry and transitivity most likely because of the greater complexity of information processing involved. It may be important to specifically train items in both directions early in therapy to teach the concept of symmetry and transitivity. A focus on teaching symmetry and transitivity early in therapy may help with generalization in later programs. This research also suggests that item mastery should be based on the ability to generalize the items learned.

Once a child is taught specific items in a structured consistent familiar location, the items should be reversed and then practiced in multiple locations with varying degrees of distraction. Generalization should occur between programs, on community outings with therapists and by parents in the child's daily life. This highlights the importance of parents being involved with therapy.

Relational Frame Theory suggests that when language is involved the same process will occur without the need for similar physical characteristics between the items (Hayes, Barnes-Holmes, & Roche, 2001). For example as the child learns words the words are not necessarily based on physical properties of the objects. The words bigger and smaller are relational and do not apply to any physical characteristic other than the relation.

Big	Big	Big
Small	Small	Small

There is not a size that corresponds to big or small. Something is big or small based on what you are comparing the object to. An elephant is big unless you are

comparing it to a building in which case it would be small. When discussing verbal events, the meanings established are socially determined. Big and small are social concepts and have no absolute physical characteristic. Relational Frame theory (Hayes, Barnes-Homes, 2001) suggests that one of the main things we learn with verbal language is socially derived arbitrary relational responding. We respond to how things relate to one and other. Are two things the same, different, distinct, how do they compare? Are two things hierarchically or temporally related? How are they related in space? How are two things related causally? According to Relational Frame Theory what we learn through language is how to frame things by how they relate to one and other.

Relation Frame theory suggests that one focus of therapy when treating children with autism should be teaching them what is the same, different, distinct, what classes they belong to and how are they hierarchically or temporally related. The child learns to abstract social concepts as they solve contingencies in their environment. The contingencies are presented by the therapist and the child learns the social values of society as they learn to predict and control their worlds.

Applied Behavior Analysis

According to behaviorists learning involves the principles of respondent (classical learning) and operant conditioning (learning by consequence). The systematic application of these principles is often referred to as Applied Behavior Analysis or abbreviated as ABA therapy. Applied Behavior Analysis is the systematic application and adaptation of behavioral principles using the single-subject-design. The single-subject-design looks at an individual and analyzes the individual behavioral responses to antecedents and consequences.

ABA therapists follow the A-B-C model. In the A-B-C model the therapist evaluates and manipulates Antecedents, Behaviors, and Consequences. Antecedents are any discriminative stimulus (any environmental event) that consistently predicts reward or punishment. As a child experiences environmental events, they start to predict from the environmental event what will likely happen next. They change their behavior to try to alter the consequences predicted by the environmental event. After altering their behavior they experience a second environmental event in the form of the consequence of the behavior. Their experience of the consequence leads them to alter their behavior in the future.

Consequences can be discussed in many ways. One standard way to speak about consequences is to define them by if the consequence is presented or taken away combined with whether behavior increased or decreased. Consequences can be discussed as positive reinforcement, negative reinforcement, positive punishment and negative punishment depending on whether something is added or taken away combined with whether behavior increased or decreased.

	Behavior Increased	**Behavior Decreased**
Present Stimuli	Positive Reinforcement	Positive Punishment (Type 1 Punishment)
Remove Stimuli	Negative Reinforcement	Negative Punishment (Type 2 Punishment)

If you present something the child likes and the target behavior increases in the future positive reinforcement is said to have occurred. If you present something the child

does not like and behavior decreases in the future Type 1 punishment has occurred. If you remove something that was desirable to the child and the behavior in question decreases in similar circumstances in the future Type 2 punishment is said to have occurred and if you remove something that was negative and the behavior increases in similar situations in the future negative reinforcement is said to occur. The above chart provides a handy way to look at and think about consequences. In reality consequences are not so straight forward. Positive reinforcement, negative reinforcement, type 1 and type 2 punishments are always working together and can not be separated. It is really a matter of which is more salient at any particular time.

Applied Behavior Analysis involves the use of the behavioral research strategy of the single-subject-design to change behavior. Learning has occurred when behavior changes. The basic strategy of ABA therapy involves operationally defining the behavior in question, taking data on some dimension of the behavior, implementing a treatment and observing and recording how the data changes.

Let us first look at how to operationally define a behavior. The target behaviors should be defined in observable terms. Say we want to target a child's frustration level. How do we define frustration so that it is observable and recordable? Frustration could be defined as physical aggressive acts toward the environment or other's. We may want to go further and spell out what aggressive acts will count. Hitting others, throwing objects, hitting objects, kicking objects, kicking people could all be specified as target aggressive behaviors. It would be easier for independent observers to count how many times one child hits another than to count how many times a child was frustrated.

Operationally defining terms allows independent observers to accurately record data on how often a behavior occurs.

Once we have a definition of the behavior, we want to change, we will want to take baseline data on the behavior. We will record the frequency, duration, latency, intensity or quality of the behavior before any intervention is implemented. The purpose of taking baseline data is to see how often the problem behavior occurs. If we did not take baseline data and we instead just started tracking data after the treatment was implemented we would have no idea if out treatment was working.

Once we get baseline data, our treatment is implemented. A change of data in the right direction suggests that the environmental manipulation was successful. A change in the frequency, latency, intensity or quality of the behavior after treatment tells us that the treatment is working. No change in the recorded levels in the above dimensions of the behavior would suggest our treatment attempt was not successful. When a treatment is not demonstrating that it is successful through the data collected it is likely that there is no functional relationship between the behavior in question and the variables you are targeting with your intervention. At this point we would evaluate the variables in question and formulate another treatment strategy.

There are many methods for recording data on each of the dimensions of behavior such as frequency recording, duration recording, and time sampling recording. The three types of time sampling methods are discrete trials, partial and whole interval recording and momentary time sampling (Rudrud, 2007). Once the method of recording data on a dimension of behavior is determined an experimental design must be chosen.

The most basic single subject design is the A-B design. During the A phase you take baseline data on a dimension of behavior. Then you initiate a treatment (B) and continue taking data. Other single subject design techniques include A-B-A-B design and multiple baseline designs. In the A-B-A-B design you take a baseline, add a treatment, withdraw the treatment and take another baseline and finally add the treatment back. What you would see with an effective treatment is that the data change in a consistent way between baseline and treatment conditions. Baseline data should be collected until the data is stable or shows a consistent trend (Rudrud, 2007). There are ethical considerations that need to be considered when choosing an experimental design. We usually use the basic A-B design because withdrawing a successful treatment would be unethical in most cases.

Usually when treating children with autism we use an A-B design. We take baseline data on some dimension of behavior (A), implement a treatment strategy (B), and continue taking data to see if the trend of the data has changed. A change in the trend of the data leads our direction of treatment. For more detailed information about design strategies please refer to Applied Behavior Analysis (Rudrud, 2007).

For example, suppose a child hits his peers often. First we would record data on the antecedents, behavior and consequences. Johnny hits most often when he is playing with blocks. In each situation where Johnny hits he is approached by a child who wants to play with Johnny and the blocks. Johnny hits the child and the child cries and runs off. From this information we have the antecedents of blocks and being approached by another child. We have the behavior of hitting and the consequence of the child running away and crying. To evaluate what the controlling variables are in this situation we could

manipulate some of the variables. Remove all blocks and give Johnny cars to play with and see if he still reacts to other children by hitting. In the above situation Johnny's hitting is probably being maintained by the child leaving. Johnny is experiencing an aversive situation because of the child's presence. He hits because in the past when he hits other children they leave. He no longer has to deal with them playing with his toys or intruding on his play. In this situation we may develop a plan to have the therapist play with Johnny and his blocks. When Johnny hit's the therapist continues to play with Johnny ignoring the hit. Since hitting no longer solves his problem Johnny must come up with another solution. We would often give Johnny other ways to solve this problem as an alternative to hitting. We would also play with Johnny more so that he started to find more rewards when other people were playing with him than he would when he plays alone.

Behaviors can be classified as excessive and deficit. Deficit behaviors are behaviors that do not occur often enough. Excessive behaviors are behaviors that occur too often. In order to increase behaviors reinforcement procedure are used. To decrease behaviors punishment procedures are used.

Rudrud (2007) describes a proactive approach to decrease the use up punishment when changing behaviors. Many behaviors that are problematic are behaviors that occur in excess. Usually problem behaviors are defined in excessive terms by teachers or parents. Johnny hits too often or yells too much. The problem with defining the target behaviors in excessive terms is that punishment procedures must be used to decrease the behaviors. The proactive approach recommends that the therapist find the opposing deficit behavior and use reinforcement strategies to increase the deficit behavior.

Punishment procedures tell a child what not to do. Reinforcement procedures tell a child what to do instead.

For example, Johnny hits children on the playground and in the classroom whenever he is frustrated. Hitting is an excessive behavior. We could provide a consequence (time out) every time Johnny hit someone. The problem with using punishment procedure is that Johnny learns what not to do but is not taught an alternative behavior. Another problem is that all behavior that is occurring is present because it is being reinforced. So in essence when we use a punishment procedure we are overlaying a punishment over a reinforcement paradigm. When the punisher is gone the behavior is still being reinforced and will likely return.

The proactive approach would involve identifying an opposing alternative deficit behavior that we can reward. In the case of Johnny hitting a deficit behavior could be defined as standing with arms comfortably at his sides. We would then set up a program where we rewarded Johnny for having his arms comfortably at his sides when he was frustrated. This is a strategy which uses differential reinforcement of an incompatible behavior often referred to as a DRI procedure.

Another alternative would be to use a DRO procedure. DRO stands for differential reinforcement of other behavior. In general, Johnny would be rewarded on an interval schedule for the absence of hitting. As long as Johnny is not hitting at the end of the interval Johnny would be rewarded. One final means of decreasing the behavior would be to place the behavior on a schedule for extinction. If the behavior is being maintained by the reaction that Johnny gets when he hits, we can ignore the hitting and

not respond. Since Johnny would no longer receive the reward for the behavior the behavior would decrease.

When teaching new behaviors with an applied behavior analysis approach we need to start with a task analysis. We break the behavior that we want to teach to the child into it component parts. A task analysis provides consistency in teaching and allows you to assess the learner's skills (Rudrud, 2007).

Many of the tasks we teach children are tasks that the child was never able to master. Since the child could not master the tasks the child could not progress developmentally. The developmental perspective provided in the next chapter provides an outline of some of the developmental tasks that need to be addressed. Many of the tasks can be determined by watching typically developing children. Usually we want to work on the simplest developmental tasks first because more advanced skills build on earlier skills.

If we are going to teach a child to come when you call the child's name the child must have mastered earlier developmental tasks such as the ability to understand and differentiate words, knowledge of contingencies presented in the environment and the ability to stand and to walk. A task analysis would identify every skill involved in coming when called. Each skill would then be individually taught. Each individual behavior would be chained together to make the more advanced behavior of coming when called. A task analysis is never complete until we are at a level with the task analysis that allows us to teach the behavior to the child. If the child can not learn the individual steps the steps are broken down further until we have a behavior that we can teach the child with the discrete trial format. There are many ways to teach behaviors

including forward chaining, backward chaining and total task presentation. Total task presentation is often used with typically developing children. Children with autism often learn faster with forward and backward chaining of behaviors.

The most basic way to teach new behaviors is to shape the behavior. Shaping refers to the process of differential reward of behaviors that approximate a target behavior. You provide positive reinforcement for closer and closer approximations of the desired behavior. Pure shaping takes a fair amount of time. We often use prompts to speed the learning of behaviors. If someone does not know what behavior is expected you prompt the correct behavior. There are many types of prompts including physical hand over hand prompting, imitative prompts or modeling, gestural prompts, verbal prompts and pictorial prompts. You can also have environmental extra-stimulus and within-stimulus prompts. Prompts when added need to be faded systematically. There are many ways to fade prompts including the most to least method, the least to most method, graduated guidance and try another way (Rudrud, 2007). In general it is important to use the least invasive prompts and to fade prompts as quickly as possible without losing the behavior.

Applied behavior analysis uses a very systematic approach to teach new behaviors. The new behaviors are chained together to create complex behaviors. Often we decrease distractions to simplify behaviors enough so that they can be learned by children with autism. Because of this, behaviors that are taught in a distraction free or distraction low environments need to be systematically expanded. Many behaviors that are learned by children with autism are very situation and environment specific. We have to program for stimulus generalization and response maintenance. One of the best ways

to program for response maintenance and stimulus generalization is to tie the behaviors that are learned into functional skills that are rewarded naturally from the environment and the community.

After a behavior is learned in a distraction low environment the behavior must be practiced in many natural environments. People who interact daily with the child need to be very familiar with what the child knows and should be given a plan to systematically generalize the learned behaviors in the natural environment. Behaviors that work for the child and make the child more successful at getting what he or she wants in the world will be maintained better than behaviors that have no practical significance to the child. Behaviors that the child wants to learn will be remembered. Schedules of reinforcement need to be thinned and reinforcement has to be transferred to natural reinforcement from the environment and society. The child should be taught how to self manage antecedents and consequences (Rudrud, 2007).

Social Context

Social context is a very important concept when planning a behavioral program. Everything the child will be learning will be in relation to the environment and to other people. Human beings are social animals. We thrive and live in a social community. Typically developing children learn almost everything they know through observational learning and imitation. Children with autism often focus on objects more than people. Because of this children with autism have a hard time learning many subtle skills that typically developing children take for granted. Building social drive in children with autism is an important foundation for any behavioral program. Attention is almost always lacking in children with autism. This is not quite accurate. Children with autism

just like children with ADHD have attention to what they are interested in. The difference between a child with autism or a child with ADHD and a typically developing child is what directs their attention. Attention is completely bound to motivation. We attend to things that interest us. In other words we attend to objects and activities that are rewarding. Remembering back the the discussion of motivation we are motivated for objects and activities which satisfy a need. Need is created by deprivation or movement away from a perceptual set-point. When a child is satiated there is no motivation and hence their will be no attention to the object of satiation. As discussed earlier most basic needs are fulfilled by an attentive caretaker. Once basic needs are met a child moves to sensory needs such as movement or looking at interesting things. A typical child quickly becomes satiated by sensory stimuli and habituation occurs. They then move on to fulfilling social needs and needs for affiliation. Social behaviors and behaviors directed at affiliation with others are complex and in most situations they are too complex for children with autism. Since social interaction is too complex for most children with autism attention is not directed or controlled by social stimuli. Children with autism typically get stuck in motivation to sensory stimuli and because of this their attention is drawn and controlled by sensory stimuli.

The basics of learning and developmental progression lie in learning to understand the concrete physical and abstract social and verbal world in which we live. A key component to any behavioral program will be harnessing a child' motivation to capture their attention and move their attention from objects and sensory stimulation to the complex social/verbal world. We do this through a systematic approach of identifying the sensory/motor activities and objects to generate action within the child.

Once action is generated a person is placed between the sensory reward and the child. Actions on the part of the child which will move the child closer to understanding social and verbal behavior are increased by allowing access to the sensory stimulation via the intermediate control of a person. Programs which systematically increase prosocial behaviors move a child from motivation controlled by sensory stimulation to motivation controlled by social affiliation. These programs will be described in more detail in the following chapters of this book. At this point we only want to mention that social attention and understanding is developed by systematically rewarding human referencing, and teaching non-verbal boundaries.

Many children with autism have a very difficult time understanding the world. They do not have the ability to receive verbal information from people and benefit from that information. Because of this they gravitate to dictating to others what should be done. It is far easier to cry until someone gets you what you want than to understand how to get it in a socially appropriate way. Children with autism often become the de facto controller of their domain. People familiar with child development and parenting practices are very aware that children need structure to thrive. Children need consistent rules, boundaries and limitation. But how do you teach these rules, boundaries, and limitations before a child is able to interact in the verbal community? We will focus more on procedures to teach non-verbal social understanding in a later chapter. Non-verbal social understanding or "street smarts" seems to be an intuitive knowledge about how the world works. You are coming to a cliff and you get an uneasy feeling in your stomach and turn back. This is emotional intelligence and it is developed through non-verbal classical learning and learning by consequences. Emotions drive behavior not thoughts

or verbal rules. Later we do learn millions of rules but the most basic knowledge is provided by how the world works when you navigate through it. Because of this there is no need to wait until a child can learn verbal rules to begin teaching emotional and social concepts. These concepts when understood nonverbally lay the foundation for later verbal understanding and reason giving. Most people would be surprised to find out how much their behavior is controlled by their emotions and social contracts that they are unaware of.

The next chapter will address developmental milestones. We present them in the next chapter not because we believe that the brain is hard wired and it is important to know when a child is developmentally ready to learn a task, but because one behavior builds upon another. Know the general progression or typical patters helps to guide a behavioral program that is attempting to duplicate and/or remediate developmental delays.