

# Principles of Movement Control that Affect Choreographers' Instruction of Dance

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## Preface

The purpose of this paper is to inform choreographers of different motor control and skill learning principles that affect instruction of dance and choreography as well as provide a resource for choreographers to make rehearsals more productive. In order to accomplish this task, I adapted the information presented in three main texts, written by Schmidt and Wrisberg, Schmidt and Lee, and Fairbrother, in order for it to be useful to choreographers. I have included dance examples rather than sport examples in order for the choreographer to more easily relate to the information. The in-text citations in this paper were kept to a minimum in order for it to be read more easily. The first section of this paper provides information about the overall premise of choreography along with the foundational information about skill learning, such as how to classify tasks and types of goals. The second section discusses the processes that the dancers experience while learning new choreography, such as memory and generalized motor programs. The final section covers information about how to best present the choreography, such as effective instruction techniques and correct use of feedback.

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## Principles of Movement Control that Affect Choreographers' Instruction of Dance

Dance is a broadly appreciated form of artistic expression. It can take the form of classical ballet, modern, contemporary movement, or jazz. People are affected by dance in many different ways. Some can be brought to tears by certain pieces while others might simply appreciate the technical skill involved. Others still might not even enjoy the piece at all. Watching dance is a personal experience that emerges in response to the combined efforts of the choreographer and dancers. The choreographer designs the movements and the dancers execute them. Both have the common goal of setting an artistic expression of movement onto a stage in the hope of evoking a certain experience in the audience. As with any art, effective expression is facilitated by certain technical skills and knowledge. The choreographer must understand how to implement an artistic vision within the constraints established by the interactions between the dancer and the demands imposed by the required movement skills and the performance setting. This understanding should be further supplemented with knowledge regarding the most effective ways to teach dancers how to meet the demands of a specific dance piece. Several principles derived from research on movement control and skill learning have fairly broad application to human performance and can presumably provide the choreographer with important information for working effectively with dancers.

### Brief Background on Choreography and Dance

#### *What is Choreography?*

A choreographed dance is a series of movements that are arranged into a *piece* by a choreographer. The term *piece* refers to the entirety of the movements that a choreographer tells the dancers to perform. A *piece* is made from several *sections*, which are each generally demarcated by a clear change in the music (e.g., a change from faster to slower music might indicate the end of one *section* and the beginning of the next). The *sections* are composed of *phrases*, the lengths of which are arbitrarily determined by the choreographer (e.g., anywhere from four counts to about four eight counts of the accompanying music). *Phrases* are composed of *steps*. A *step* is the smallest designation of movement in dance (e.g. a turn or a sauté, which is a small jump). *Steps* are also referred to as movements. In this paper, however, the components of a *phrase* will be referred to as *steps* and the term movement will be reserved for discussion of aspects related to any physical movement involved in dance (e.g., a jump or arm extension). In addition, choreographic terms will be italicized throughout the paper to avoid confusion with other more general uses of certain words.

#### *The Role of the Choreographer*

The choreographer is the main force behind a dance *piece*. According to Smith-Autard (1996), successful choreography depends on the choreographer's "artistry and intuitive inspiration, [...] wide vocabulary of movement as a means of expression, and knowledge of how to create the shape and structure of a dance." The choreographer must consider several key elements when designing a *piece*, including the music, the number of dancers, and the *piece's* meaning and inspiration. Humphrey (1959) argued that the meaning and inspiration of the *piece* should be felt passionately by the choreographer or emerge from his or her personal experience. The choreographer provides a foundation for the artistic expression in the *piece* by describing the specific qualities of the movements to the dancers. For example, the artistry of a movement will

change if the dancers are told to smile and lengthen their jumps as opposed to showing no emotion and complete short and abrupt jumps.

The choreographer must also have a strong knowledge of a wide variety of dance movements that can be used to effectively present the meaning of a *piece*. This knowledge would be analogous to a soccer coach's grasp of the fundamental movements required for the game of soccer (e.g., dribbling, kicking, and passing). Ideally, a choreographer will be able to select movements from a variety of dance styles such as jazz, ballet, and modern. In addition, it is also common for a choreographer to construct new movements as needed. A choreographer also needs to be aware of the different ways male and female dancers interact through lifts, turns, or other complex *steps*. In general, a choreographer must command an extensive range of knowledge regarding the way movement can be used to convey an artistic vision.

In its simplest form, the development of a dance *piece* requires the choreographer to assemble various combinations of *steps* into *phrases* that coordinate with specific counts in the music. The *phrases* would then be organized into the *sections* that constitute the entire *piece*. In practice, however, the organization of these different levels is made more complex by considerations related to how a *piece* displays shape and structure through the use of different formations of dancers. For example, a choreographer might decide to have a set of five dancers clustered in one corner of the stage or have them aligned in a "V" shape across the center of the stage. Either of these formations might move across the stage in different patterns, some symmetrical and some asymmetrical. In addition, dancers in a set might perform *phrases* together or separately (e.g., with one dancer performing a unique *phrase* while the others all perform a common *phrase*). Other elements of space include the direction of movement, planes of the movement, density of the dancers, and range or size of the movement (Hayes, 1955). Combining all these elements is challenging, but it allows the choreography to add dimension that makes a *piece* more interesting.

Once a *piece* is developed, the choreographer must *place* the movements onto the dancers, which refers to process of instructing the dancers which *steps* to complete and when to complete them as dictated by the *phrases* and *sections* as well as other considerations of movement, space, and artistic expression. This aspect of choreography is analogous to a coach introducing a new play to athletes in team sports. The choreographer must effectively communicate his or her vision for the *piece* while also instructing the dancers regarding technique and organizing rehearsals to facilitate the best possible outcome during the ultimate performance of the *piece*. The success of this instructional aspect of choreography can be greatly enhanced through the application of several key concepts and principles regarding how people control movements and learn movement skills.

### *The Role of the Dancer*

The role of the dancer is to learn the elements of a dance *piece*, rehearse them under the direction of the choreographer, and ultimately perform the *piece* for an audience. In learning a *piece*, dancers must master the execution of *steps*, coordination with other dancers, and the timing of *phrases* and *sections*, and combine these technical details with expressive elements (e.g., smiling) appropriate to the tone of the *piece*. Martha Graham, a famous modern dancer and choreographer, once said that a dancer should "learn by practice" (Martha Graham). Indeed, extensive practice is the key to a dancer's success. Because *phrases* involve sequences of

movements that are pre-determined, extensive practice can lead to a process known as procedural learning. When a movement sequence becomes proceduralized, its execution will require little direct attention from the performer and the performance becomes somewhat “automatic”. Ideally, the dancer will be able to proceduralize the movements required by several successive *phrases*, perhaps even an entire *section* or *piece*. The dancer, of course, must also learn to “feel” and express the emotion that the choreographer intends the *piece* to convey. The proceduralization of *steps* and *phrases* will allow the dancer to devote attention to the emotional qualities of the dance. Some dancers create a back story for a *piece*, which helps them capture and ultimately exhibit the appropriate emotions. Ideally, extensive rehearsal will help enable the dancers to reach a point of automaticity for the movements involved in expressing emotion. At this point, a dancer might focus on higher order aspects of the *piece* such as the personal artistic meaning and how it is expressed.

Sometimes a dancer, especially one with extensive experience, may have more of a collaborative role with a choreographer. In such cases, the dancer can provide valuable insight about ways of moving that might feel more natural for a dancer or ideas for movements that seem appropriate for a *piece*. The dancer can also provide the choreographer with information about what it’s like to learn and rehearse a particular *piece*. Sometimes a choreographer will ask a dancer to improvise for a certain number of counts, which gives the dancer an active role in developing a portion of the choreographed *piece*.

In general, the role of the dancer is to be molded into what the choreographer envisions. The dancer must effectively perform the desired *phrases*, which requires practice and time. The dancer must also dance the movements with the desired emotions and, at times, has adopted an active role in the choreographic process. The dancer’s job is to embody all of the relevant aspects of a *piece* and then perform the dance in a way that conveys the intended artistic expression.

## Movement Control and Skill Learning Foundational Information

A wealth of information has been published about how to choreograph. In addition to these resources, college students majoring in dance may also take classes that teach them the process of transferring a *piece* onto a set of dancers. Topics might include how to begin and end a *piece*, the use of repetition, understanding how to use space, and understanding plagiarism of *phrases* or *steps*. These concepts are all important when actually constructing a piece. To become an effective choreographer, however, one must also recognize how the requirements of the *piece* match the capabilities of the dancers, how to best present the required movements to the dancers, and how the dancers will learn to execute the movements. These concepts related to the performance and learning of new movement skills are well documented in the field of motor behavior.

The field of motor behavior is concerned with the study of how individuals control movements and learn movement skills. Although the concepts and principles from this field might seem most suited to learning and performing sports or industrial skills, the information can be readily applied to the instructional aspects of choreography (or any other endeavor that requires technical movement skills). The topics that are most relevant to dance and choreography are related to how well a dancer can meet the performance demands created by a dance *piece* and the processes a dancer experiences during learning movement skills. To provide

a framework for the application of specific concepts to choreography, some fundamental concepts from motor behavior will first be introduced.

### *Conceptual Framework*

A common conceptual framework in motor behavior identifies the significance of the person, task, and performance setting, and emphasizes the importance of their interactions when trying to understand the performance and learning of movement skills (Fairbrother, 2010; Schmidt & Wrisberg, 2008). Consideration of each of these three elements provides insight into the performance of dance and the factors a choreographer should consider when working with dancers. A key feature of this conceptual framework is the recognition that a change in any dimension of one of the three elements can dramatically influence the way an instructor should approach a situation. For example, even a fairly subtle difference in experience or preference might cause one dancer to need more thorough demonstration compared to another. The central *take home message* of the framework is that instruction should account for the influence of all three elements on the ultimate performance of a skill and be tailored to the individual whenever feasible.

*The Person.* The first element of the conceptual model to consider is the person. For the sake of choreography, it is safe to assume that the person will always be a dancer. Generally, more complex choreography will require more skilled dancers. Even at the highest levels of skill, individual differences in perspective, experience, motivation, and dancing skills will require some flexibility on the part of the choreographer (Schmidt & Wrisberg, 2008). Experienced choreographers understand that all dancers have unique strengths and weaknesses as well as personal preferences that often need to be accommodated. Therefore, it is important to understand how the people involved in a *piece* will respond to rehearsal and tailor the experience in ways that will facilitate learning.

*The Task.* The second element to consider involves the demands of the task, which in this case is dancing. The task dictates the skills that must be mastered by the person within a specific performance setting. In general, choreographed dance requires the dancer to learn movement sequences, correct placement on the stage, timing of movements with respect to music, coordination of limbs, and coordination of movements with other dancers. Because the task always takes place in a certain performance setting, this setting will have a strong influence on the demands that a person faces. For example, dim lighting on stage can make placement more difficult for a given *piece* compared to when the lighting is brighter. As mentioned earlier, task demands are also influenced by individual differences in the dancers. That is, the same *piece* may be more difficult to learn for one dancer compared to another.

*The Setting.* The third element of the conceptual framework to consider is the performance setting. The most obvious setting for performing choreographed dance is the stage, whether it is in a local church or The Metropolitan Opera House in New York City. Although most dancers will be familiar with a theater stage, they might on some occasions be asked to perform in a variety of locations such as a park or even on a football field during a half time show. The nature of the audience might also influence the performance of a *piece*. Performing in front of large audiences or those with influential members can make many dancers anxious. This anxiety can lead to a narrowing of attention and degraded performance. Another consideration regarding setting is the difference between rehearsal and the ultimate performance.

It might be difficult for some dancers to transition from a simplified rehearsal environment in a studio or empty theater to performing in front of the audience. The choreographer can help dancers with this transition by incorporating elements of the actual performance setting into rehearsals.

### *Task Classification*

Motor skills are often classified in various ways to identify the demands they impose upon the performer. Because dance involves motor skills, certain classification schemes can be used to help the choreographer better understand the particular demands that a dancer will face. The three most common skill classification schemes are based the degree of unpredictability in the performance setting, the way in which the elements of a task are organized, and the degree to which task demands are cognitive or motor (Schmidt & Wrisberg, 2008). A choreographer can benefit from understanding where various dancing skills fit into these classification schemes so that decisions about *steps* and *phrases* are consistent with dancers' capabilities.

*Open versus Closed Skills.* One way to describe the demands of a skill is to identify the extent to which its performance setting changes and the degree of predictability of such changes. Closed skills are those that are performed in relatively stable and predictable settings. As such, they do not require much "in-the-moment" decision making but instead emphasize appropriate planning and execution. For example, a dancer performing a pirouette alone on a stage will be executing a closed skill. His focus will be on the effective execution of proper technique. In contrast, open skills are those that are performed in settings that are dynamic and usually somewhat unpredictable. Because of the changing nature of the setting, the performer must pay close attention to information from the environment and make appropriate decisions in order to adapt as needed. For the most part, dance skills are executed in relatively closed environments. There are some situations, however, that might call for limited decision-making by the dancer as she performs. For example, any movement that requires multiple dancers to improvise in close proximity will require the dancer to monitor the environment and make adjustments in response to somewhat unpredictable changes. In addition, dancers may occasionally be required to adapt to errors in execution which suddenly change the space available to complete a subsequent skill.

In general, choreographers would probably not spend any time on open-skill training except when planning improvisational pieces. Accordingly, the focus when training dancers to complete a movement would be on the factors that will help them prepare for and execute specific movement skills, including transitions between skills in a sequence. From the perspective of learning to manage specific task demands, it would not be advisable for a choreographer to introduce decision-making elements into practice. For example, there may be some situations that require a dancer to transition from Skill A to Skill B early in a movement and then transition from Skill A to Skill C at a later point. In these cases, choreographers should avoid any temptation to place dancers in a practice situation that would require them during the execution of Skill A to decide between transitioning to either Skill B or C (e.g., in response to a verbal command). While this will undoubtedly make practice more challenging for the dancer, it will inappropriately focus training on a decision-making demand that the dancer will not face during an actual performance.

*Discrete versus Serial versus Continuous Tasks.* Another way to describe a skill is by how it is structured. Discrete skills are skills that have a clear beginning and end; they are also

generally performed very quickly. Examples in dance include single *steps*, such as a grand jeté. The beginning is when the dancer begins the leap, and the end is when the dancer has landed the leap. A choreographer needs to be aware of this classification because discrete skills generally do not allow the performer to make any corrections once they have been initiated. Any feedback that is received about a specific performance of a discrete skill can only be used to adjust a future attempt. Therefore, the choreographer should help the dancer focus on using information available before the movement begins (e.g., identifying the appropriate mark on the floor) and allow for enough practice so that any new discrete skills can be mastered.

Continuous skills are those that have no clear beginning or end (Schmidt & Wrisberg, 2008). These skills are cyclical in nature. Examples include running and swimming. To discuss the cyclical motion in running, agreement must first be reached to decide if a cycle starts when the heel strikes the ground or when the toe leaves the ground (or at some other point). Without such an agreement, it can be hard to distinguish where the skill begins and ends. Repeated spins or running across stage could be considered continuous skills in dance. An important feature of continuous skills is that they often occur over a long enough time that the performer can actually make adjustments during the performance. For dancers, this can be beneficial in detecting and correcting errors during rehearsal. For example, a dancer might detect that his arms are out of position on a first spin and then correct them for the following spin. Although this would not be ideal during the actual performance, it would still be preferable to executing two incorrect spins in a row. In other cases, the audience might not be able to detect a correction to a continuous skill as might be the case when a dancer subtly adjusts her stride to hit a mark on the other side of the stage.

Serial skills involve a series of two or more discrete components. A *phrase* would typically be considered a serial skill, composed of discrete *steps*. Sometimes the discrete components can be easily recognized when viewing a serial skill as would be the case for a slowly executed *phrase*. In other cases, the discrete components might unfold so rapidly that it can be hard to identify all the components that are involved. This should not be a problem in most cases, however, because the choreographer will have assembled the *phrases* and will of course know which discrete components went into them. Serial skills can also contain components that are somewhat continuous in nature. An example from sports is the pole vault which contains the continuous skill of running during the approach. In dance, certain *phrases* might involve continuous skills such as when a dancer spins (continuous) and then jumps (discrete). When placing *phrases*, it can be helpful for the choreographer to slowly demonstrate each *step* to ensure that the dancers can identify every movement component. It might also be beneficial to allow the dancers to practice *phrases* slowly until they know each *step* and the sequence. After that, the speed can be increased incrementally until the dancers can perform at full speed.

*Motor versus Cognitive Tasks.* A final way to categorize a skill is by determining its level of motor or cognitive demands. As the name implies, a motor skill involves the body; the movement quality is an essential determinant of success. Motor skills are the main component of dance; the correct movement, shape, and execution of dance are crucial for a successful performance. Cognitive skills are those that require more mental activity, decision making, and strategy in order to be determined as successful. According to Schmidt and Wrisberg (2008), a cognitive skill's "success depends more on the strategy dictating the movement than on the

production of the movement itself”. Cognitive aspects of dance include monitoring the environment for cues. Examples of cognitive aspects of dance include when a dancer listens to the music to anticipate when to make an entrance, scans the floor to ensure she hits her mark, monitors others in a formation, or makes adjustments based on the movements of others or to compensate for errors.

### *Motor Performance versus Motor Learning*

In order to accurately assess how well dancers have mastered the skills required in implementing a dance *piece*, it is important that a choreographer can distinguish between motor performance and motor learning.

*Motor Performance.* Motor performance is the observable behavior of a person as they execute a movement skill. One example from dance would be how well a dancer stays in time with the music. It is a common misconception that observable performance is a good indication of the level of learning that a person has reached. Performance, however, is susceptible to the temporary effects of factors such as ”motivation, arousal, fatigue, and physical condition” (Schmidt & Wrisberg, 2008). These temporary effects can act to either improve performance (e.g., a motivated dancer) or degrade it (e.g., a fatigued dancer). When these factors are removed, performance will change. For example, it would be common for a dancer to perform well in rehearsal when he is motivated by the choreographer’s praise but perform poorly during a dress rehearsal when he is anxious and feedback is withheld until the end of the entire *piece*. A choreographer can measure motor performance in a number of ways by making observations during rehearsals. These observations might be subjective (e.g., when the choreographer judges a dancer’s expressiveness) or objective (e.g., recording the time it takes to complete a *section*). The most important idea about motor performance for a choreographer to remember is that it is not a direct indication of how much a dancer has learned. To assess learning, performance must be observed under a specific set of circumstances, which will be outlined next.

*Motor Learning.* In contrast to motor performance, motor learning cannot be observed. It can only be inferred from performances under certain conditions. In the motor behavior literature, these circumstances are called retention and transfer tests. The key element of both of these types of tests is that they are given at some point after practice. This delay period must be long enough to ensure that any temporary effects of performance variables have worn off. It is also important to try to limit the effects of any performance variables that might be present during testing. In dance, a full dress rehearsal can act as an assessment of learning as long as the choreographer (or anyone else) refrains from providing feedback or motivational statements and the dancers are fresh. Choreographers may also want to incorporate periodic evaluations throughout the course of rehearsals to assess how well dancers have learned certain skills (and then adjust rehearsal as needed). This is a recommended practice as long as the testing is done under conditions that allow the choreographer to draw conclusions about actual learning. Simply observing performance during rehearsal will often lead to incorrect conclusions about the readiness of a dancer for the actual performance.

### *Target Skill, Behaviors, and Contexts*

Identification of target skills, behaviors, and contexts is an essential component of designing instructional experiences and evaluating a learner’s performance. Target skills are

simply the actual skills to be performed. A target skill in dance might be the performance of a plie or pirouette. Target skills might be composed of more than one movement element, which the choreographer might focus on separately during early rehearsals. The concept of a target skill reminds the dancer and choreographer that the ultimate goal is to be able to perform the actual movements required when performing the entire dance *piece*. Target behaviors are observable behaviors that help define the correct performance of a target skill. For example, a plie should be executed so that the knees bend and straighten in a smooth and continuous fashion. So, the choreographer might monitor this target behavior to ensure that a dancer's technique is correct. The identification of specific critical target behaviors for each target skill allows the choreographer to focus observation on the elements of a movement skill that are deemed most important for success and allows for the delivery of specific feedback that the dancer can use to modify behavior when necessary. The target context is the performance setting in which the target skills will ultimately be performed. For dance, the target context will always be the setting of the actual stage performance. Identifying the target context reminds the choreographer to organize rehearsal appropriately. Because the target context for rehearsal is the studio, the choreographer must account for how it differs from the target context for the actual performance.

### *Goal Setting*

Setting goals is common process with broad application in everyday life. Effective goals are designed to guide a person in moving toward what they hope to accomplish. Accordingly, it is often recommended that goals be challenging, attainable, realistic, and specific (CARS) (Schmidt & Wrisberg, 2008). It is helpful to set goals in choreography to help the choreographer and dancers identify what types of improvements they want to accomplish. Setting goals may come more naturally to some than others. Dancers and choreographers can sometimes have divergent goals. For example, a dancer's goals will typically be focused on mastering the physical performance of a *piece* while a choreographer's goals might sometimes be focused on broader issues related to the management of the *piece* as a dance production. The choreographer can facilitate a dancer's preparation by adopting a collaborative approach to setting goals. Participants who set their own goals will typically be more involved in the process of attaining those goals and more excited about their participation (Tubbs, 1986).

During the goal setting process, the choreographer should be careful not to focus on only certain aspects of the CARS recommendation. For example, a goal of finishing a *piece* in a one-hour rehearsal would be challenging and specific, but not realistic or attainable. A better goal would be for the choreographer to add one minute of choreography during each one hour rehearsal (in general, in order to complete one minute of choreography, a one hour rehearsal is needed). This goal is much more attainable and realistic because it will give the choreographer and dancers time to practice their work on the *sections* and *phrases* as needed. The goal is also specific (requiring that a certain amount of work be finished in a given time) and challenging (one hour is not all that long when considering the amount of detail that goes into a rehearsal). Although this goal would provide good general guidance for rehearsals, it is likely that the choreographer and dancers would also set even more specific goals about nature of the work to be done during each rehearsal (e.g., reaching an acceptable level of mastery for a challenging *phrase*). It will also be helpful to set both short-term and long-term goals because doing so can create a continuous sense of accomplishment.

*Process versus Outcome Goals.* When setting goals, the dancer or choreographer should determine which type of goal to set. Process goals focus more on the “process or technique of the movement” (Fairbrother, 2010). Examples of process goals for a dancer might include successfully remembering new material from one rehearsal to the next or displaying correct arm position during an arabesque. Process goals can sometimes be difficult to measure when they are related to the overall pattern of movement as opposed to one particular aspect. In these cases, the choreographer should pay careful attention to developing ways to accurately assess a dancer’s progress towards the goal. Outcome goals focus on the measurable outcomes for a performance (Schmidt & Wrisberg, 2008). Examples of outcome goals for a dancer might include consistently completing a triple pirouette or matching the accompanying musical count for all *steps* in a *phrase*. Once appropriate process and outcome goals are set, the choreographer must identify appropriate ways to measure performance with respect to a goal and provide feedback to the dancer. Goals, measures, and feedback must all be consistent with one another. For example, a process goal should always be paired with a measure of the related process and feedback should focus on that process. It is sometimes tempting to use outcome measures and feedback (because they are often easier to detect) even for process goals. Although seems logical in that the process should lead to the desired outcome, in practice it can be frustrating to the learner.

### *Stages of Learning*

Individuals move through several distinct stages when learning new motor skills. In many cases, dancers working with choreographers will already have mastered movement skills related to the execution of *steps* in a dance *piece*. Because each choreographed *piece* is unique, however, even skilled dancers will move through several stages as they learn new *phrases* and *sections* during rehearsals. Several different models have been proposed to describe these stages (e.g., Fitts & Posner, 1967; Gentile, 1972). The most straight-forward descriptions of each stage are those offered by Schmidt and Wrisberg (2008) and will, therefore, be used in this section. The three stages are called the verbal-cognitive stage, the motor stage, and the autonomous stage.

*Verbal-Cognitive Stage.* In the verbal-cognitive stage, the dancer must intently focus on performing the movement. In this stage, the dancer will be learning *what to do* (Schmidt & Wrisberg, 2008). For example, a dancer might be focusing on remembering the sequence of *steps* in a particular *phrase*. Consequently, movements will be slow to support the cognitive processing in understanding how to piece the steps together. As the name of this stage suggests, the dancer will probably verbalize the movements through overt or internal self-talk. Performance will be very inconsistent, but improvements will be dramatic. The choreographer can assist dancers in this stage by providing instructions and demonstrations, simplifying task demands, and providing enough time to “think through” the tasks.

*Motor Stage.* Once the learner knows *what to do*, focus will shift to learning *how to do* as he or she moves into the motor stage (Schmidt & Wrisberg, 2008). In the motor stage, the dancer should have a fairly good grasp of *steps*, *phrases*, and formations, and will begin to focus on the most effective ways to execute them. The motor stage generally lasts longer than the verbal-cognitive stage because perfecting or refining the movement can be a difficult task. During this stage, the dancer will be increasingly capable of detecting and correcting errors, and will be focusing on improving consistency of execution. Improvements will become less dramatic and in some cases may not be immediately observable. The choreographer can support

a dancer in the motor stage by providing adequate opportunity to practice, and by gradually increasing challenges during rehearsal so that they more closely approximate the target context.

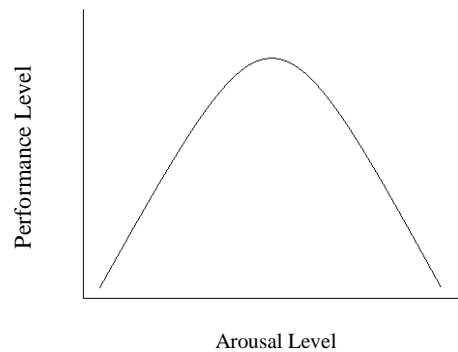
*Autonomous Stage.* The third and final stage is the autonomous stage. In this stage of learning, the dancer will be able to execute movement skills with very little explicit attention. At this point, a *phrase* would likely be fully proceduralized. Performance will be extremely accurate and consistent. Because movements are automated, however, the dancer might not be able to explicitly describe what he or she does during performance. Performance during this stage can look effortless and the dancer will be able to devote attention to other tasks, such as conveying the appropriate emotional tone of the *piece*. The choreographer can support the dancer in this stage by ensuring that the rehearsal setting closely matches the demands associated with the actual performance context. Dancers in this stage will likely need expert coaching if areas for improvements are identified, so the choreographer should recognize when it might be necessary to bring in another expert as a consultant. In addition, calling attention to the execution of movement skills can dramatically degrade performance if it moves the dancer back to the motor stage.

## Motor Learning for Dancers

In order to become a productive choreographer, it is essential to understand the processes the dancers undergo while learning new movement. This section will cover topics that focus on how a dancer processes new information and uses it to regulate movements. This section has very important information for choreographers because it describes the main ways dancers are able to learn movements and later perform them.

### *Arousal-Performance Relationship*

The arousal-performance relationship describes how performance is affected by the arousal level of the performer. The arousal-performance relationship can be easily described using a figure (see below). The level of arousal is indicated by the horizontal axis and the level of performance is indicated by the vertical axis. The shape of the relationship is described as an inverted-U. As can be seen in the figure, low levels of arousal are associated with low levels of performance. As arousal increases, so does performance, but only up to a certain point. At the peak of the inverted-U, performance is at its highest level and arousal is moderate. After that point, increased arousal is associated with decrements in performance.



Adapted from Yerkes and Dodson Model (1908)

Arousal can be thought of as the level of alertness. Low arousal is when the individual is not alert or perhaps even asleep. An individual does not exhibit mental or physical energy when in a low arousal state. At the other end of the spectrum, high arousal, the individual is very alert or energized (Fairbrother, 2010). Arousal is thought to influence performance through its effects on attention. At low levels of arousal, attention is broad and the performer might not be focusing on the task. As arousal increases, attention narrows until the performer is paying attention to all relevant cues and nothing else (Easterbrook, 1959). This is the peak of the inverted-U. Further arousal narrows attention to the point that the performer starts to miss some relevant information and performance suffers. Arousal can be caused by physical exertion as when a dancer physically practices movement skills. It can also be caused by anxiety (nervousness or apprehension).

Some dancers might have what is called high trait anxiety. That is, they are generally anxious by nature. These individuals may need help with arousal regulation so that their anxiousness about performance does not result in over-arousal. Almost everyone experiences some level of heightened nervousness before a public performance. This is called state anxiety because it is created by a specific situation. When the stakes of a performance are particularly high for a dancer (perceived or real), there is a good chance he or she might become over-aroused and “choke”. It is important for choreographers to remember that arousal levels will differ for different dancers and even for the same dancers in different situations. When it comes to helping dancers reach optimal arousal, an individually tailored approach is critical.

The optimal level of arousal will also vary depending upon the nature of the skill that is performed. Movements that require complex, fine motor skills or high levels of cognitive processing (e.g., in-the-moment decision-making) are best performed at a relatively low level of arousal. For these types of skills, the inverted-u will shift to the left and become narrower. In dance, an intricate sequence of footwork would be consistent with this type of task, especially if done in a dynamic and interactive way with other dancers. On the other hand, movements that require gross motor skills and less cognitive activity would cause the inverted-U to shift to the right and become broader. In dance, lifts and strenuous sequences of jumps would require a relatively high level of arousal for optimal performance. The majority of dance movements, however, will likely fall somewhere between these extremes.

Not only does the arousal-performance relationship have a unique shape for each type of motor skill, but it has a unique shape for each individual. The maximal level of motor performance for an individual will occur at varying degrees of arousal; this concept is termed the individual zone of optimal functioning (IZOF) (Hanin, 2000). It is important for each individual to be aware of how much or how little arousal is required to perform optimally. The IZOF concept can remind the choreographer that even when two dancers perform the same movements they may do so at different levels of arousal to reach their own peak performance.

Because many dancers can be quite anxious, especially right before a performance, knowledge of the arousal-performance relationship can be tremendously beneficial in a choreographer’s efforts to help dancers perform at their best. The choreographer should be aware that elevated arousal can come from several different sources (e.g., anxiety or physical exertion) and should take steps to ensure that he or she does not inadvertently contribute to the problem. The choreographer can support dancers by being aware of individual needs related to arousal, remembering not to introduce new information right before a performance (e.g., last minute changes), helping dancers find arousal regulation training through the services of a mental training professional or sport psychologist.

### *Information Processing*

The information processing approach to understanding human performance is based on the observation that people use information to make decisions and regulate their actions. The simplest version of an information processing model includes three stages to describe how input (e.g., a cue from the environment) is processed by a person to produce a desired output (e.g., a movement) (Schmidt & Lee, 2005).

The simplest information processing model is separated into three stages: stimulus identification, response selection, and response programming. All three stages together compose what is called reaction time, which is the total time between when an unexpected stimulus and the beginning of a response. We normally think of reaction time in situations that require rapid responses to a cue (e.g., a 100 m sprint start in track), but the three stages also apply in other situations when information is used.

During the stimulus identification stage, a person must “identify incoming information” (Schmidt & Wrisberg, 2008). The main senses a dancer will use to identify relevant information are vision, hearing, touch, and proprioception and kinesthesia. Proprioception and kinesthesia can be thought of as the senses that let someone know the position and movements of his or her limbs. These two senses would be used, for example, when a dancer can sense the quality of her rear leg movement and position during an arabesque. A dancer can shorten the amount of time spent on this stage by learning to recognize patterns in complex information. For example, imagine that one dancer (Dancer A) is told to move in a straight line ending on center stage after three other dancers (Dancers B, C, and D) pass in front of a specified part of the stage. If the three dancers are out of position or time by even a little, the Dancer A must perceive where they are and then react to the situation. With experience, Dancer A might quickly be able to detect that the other dancers are out of alignment, which would facilitate a faster response compared to detecting the position of each individual dancer. To prepare for situations such as this one, the choreographer and dancers should continually work to identify patterns that can be quickly used to diagnose problems and then practice noticing them.

Once Dancer A has recognized the problem, a decision must be made. This processing occurs in the response selection stage. The greater the number of possible responses, the longer it takes to complete this stage. Therefore, to facilitate a quick reaction the dancer should have as few choices as possible. To reduce the number of choices, the choreographer should prepare contingency plans for situations that might require rapid decision making by dancers. For example, the choreographer might work with Dancer A to pre-determine the appropriate responses if Dancers B, C, and D are misaligned in various ways. If one type of misalignment indicates they will be late to reach center stage, Dancer A’s response would be to move in front of them. If instead it appears that they will be early, Dancer A would move behind them. . Having pre-determined responses will greatly facilitate Dancer A’s decision making during the moment should this particular mishap occur. The choreographer should identify potential trouble spots in the *piece* and help the dancers prepare to respond appropriately.

In the third stage, response programming, the dancer prepares a “program” (a set of commands) that will be carried by his nervous system to his muscular system to create a pattern of movement. Two important features of response programming are worth remembering. First, more complex movements take longer to prepare. Second, response programming time can be reduced through extensive practice. Once Dancer A makes his decision, he must prepare his body to execute the intended action. If he decides the other dancers will reach their spot a little bit late, he would prepare to move in front of them. To do this, he might take a faster and more forceful first step or increase his speed uniformly for all of his steps. The choreographer and dancer should consider how these two actions might affect the duration of response programming, choosing in advance the one that will result in the least added complexity. If a situation such as the one described in this example is likely to occur, then the choreographer

might decide to devote some portion of rehearsal to practicing it. In general, however, rehearsal time will be better spent helping dancers get to the point where such situations do not occur.

### *Anticipation*

In most situations, a dancer will not be faced with a need to make rapid in-the-moment decisions as described in the previous section. Because most elements in a *piece* occur in a predictable fashion, the dancer will instead use anticipation to greatly facilitate information processing. Anticipation involves completing the response selection stage before the stimulus is even presented, based on knowledge of what is upcoming. In the previous example, if the line of dancers did everything correctly, Dancer A would use anticipation to regulate his entrance. He is familiar with what is coming and all the signals that lead up to it, so he can prepare he already knows what to do and can prepare his response. All he needs to do then is wait for the cue that signals his entrance. In some cases, effective anticipation can reduce a reaction time interval to zero. This happens frequently in choreographed *pieces* as dancers spend a great deal of rehearsal time learning to anticipate each other's actions and coordinate the timing of movements. A choreographer can facilitate the development of anticipation skill in dancers by identifying the different types of information that can be used to make decisions in advance of the signal to act. For example, the choreographer might indicate that a *step* should be made exactly two counts after another dancer completes a jump. Effective anticipation requires the dancer to know how to predict a cue to action, what the appropriate action is, and how to execute the action (Fairbrother, 2010).

*Spatial (or event) Anticipation.* Spatial anticipation is best described as anticipating *what* will happen in the environment before any stimuli are presented (Schmidt & Lee, 2005; Schmidt & Wrisberg, 2008). For example, when a *piece* calls for a lift, both dancers know what will happen as the move into their respective positions. In most dance situations, spatial anticipation will not be much of an issue because dancers will know the elements of a *piece* through their work during rehearsals. Because errors will also be encountered during rehearsal, an astute dancer might also learn to anticipate when things are likely to go awry by the quality of movements leading up to a critical point. The dancer should be encouraged to use such anticipation skills as they can greatly facilitate a corrective response should one be needed.

*Temporal Anticipation.* Temporal anticipation involves predicting *when* a certain event will occur (Schmidt & Wrisberg, 2008). Temporal anticipation is fundamental aspect of successful dance. To keep time with music, a dancer must anticipate the count and prepare to move in time. Waiting for a point in the count and then reacting would result in an unacceptable lag between the music and the dancer. Effective coordination with other dancers and transitions from one skill to another both also require temporal anticipation. Extensive practice and awareness that anticipation should be used is the key to success in these types of situations.

*Disadvantages of Anticipation.* Anticipation is not without its disadvantages. One fairly common mistake seen near the end of the rehearsal phase is when a dancer “over-anticipates” and transitions out of a movement too early. Choreographers will sometimes need to emphasize that the dancer concentrate on completely finishing a movement before transitioning to the next. Another cost of anticipating can be seen when a dancer simply makes a mistake and predicts that something will happen when it actually doesn't. In the previous example of the dancer who must move across stage in response to a line of three dancers moving forward, a mistake in

anticipation could lead to disastrous results (e.g., a collision or major disruption of the formation).

### *Attention*

Dancers, along with everyone else, are only able to direct their attention to a limited amount of information (Fairbrother, 2010; Schmidt & Wrisberg, 2008). It is impossible to attentively note every piece of sensory information the body receives at one time. For that reason, it is essential for the choreographer to help direct the dancers' attention to the most relevant cues from the environment and the dancer's own body. Because of the limited nature of attention, performance can suffer when a dancer is presented with more information than they can manage. In early stages of rehearsal, dancers will likely need to devote all of their attention to execution of the skills and sequences of movements. In these cases, and additional information can be problematic. One common source of such interference is when a choreographer or someone else talks to a dancer during the execution of a movement. Instruction and feedback should be reserved for after the attempt is complete. In some cases, it might be beneficial to practice without music initially so the dancer can concentrate on learning the movements without devoting attention to keeping time. Another potential distraction can be created by constraints on the practice space that require the dancer to monitor his or her position. As the dancer moves toward the autonomous stage, attentional resources will be available to focus on such secondary, but nonetheless, critical elements.

A choreographer can help a dancer with attentional demands in two primary ways. First, rehearsals can be structured to create attentional demands that are appropriate for the dancer (as just discussed). Second, the choreographer can help the dancer to choose an appropriate attentional focus. Attentional focus options can be described as a combination of either a broad or narrow focus with either an internal or external focus (Nideffer, 1976). An example of a narrow internal focus is when a dancer focuses on pointing her feet more during a grand jeté. An example of a broad internal focus is when she instead focuses on what it feels like to lengthening all of the elements of a movement. A narrow external focus can be seen when the dancer focuses on her spacing relative to one other dancer in a formation, while a broad external focus can be seen when the dancer is monitoring the movement of an entire formation. Some research has indicated that an external focus of attention facilitates motor performance (Wulf, 2007). On the other hand, it seems plausible that there are situations that would call for an internal focus. Although this issue has not been completely settled in the research literature, the choreographer can use Nideffer's categories to identify focus cues that seem worthwhile and evaluate them through trial-and-error.

### *Memory and Forgetting*

One of the major demands placed on a dancer is remembering the choreography from one rehearsal to the next or from the beginning of one rehearsal to the end of that same rehearsal. Great memory skills are essential for a dancer to succeed in the dance. A dancer who lacks memory skills will most likely suffer while learning choreographed *pieces*. One of the major distinctions in memory is between short-term and long-term memory. Both of these concepts are crucial for a choreographer to understand because dancers need to remember choreography over both short and long durations. Understanding these concepts will also help the choreographer understand why dancers might at times forget critical aspects of the dance *piece*. Knowing how

and why these processes occur will eliminate some frustrations a choreographer might experience from having unrealistic expectations regarding a dancer's capacity to remember.

*Memory: Short-Term Memory.* Short-term memory describes how a limited amount of information is stored for a relatively short amount of time: seconds to minutes (Sage, 1984; Schmidt & Lee, 2005). In most situations, short-term memory is thought to be limited to seven plus or minus two pieces of information (Miller, 1956). For choreography, one piece of information might be an instruction about the placement of a single limb, which means there would be four pieces of information per count. If the placement of the limbs is very familiar (i.e., previously learned), then one count might only represent one piece of information. During the process of learning, the dancer would have taken the original four pieces of information and "chunked" them together as one element (Sage, 1984). This is the same thing that happens when a person learns a new phone number. At first, an unfamiliar area code is stored as three unique digits in a specific sequence. Over time, however, that information gets chunked into a single unit that is relatively easy to remember. So, in dance the total amount of information per count will differ for each dancer based on how familiar each individual is with the presented information. To work within dancers' short-term memory capacities, it is wise to present no more than four counts of instruction at a time until the dancers have had an opportunity (through practice) to chunk some of the information.

To retain information in short-term memory, the dancer must direct attention to it. Once attention is directed elsewhere, at least some of the information in short-term memory will most likely be lost (Schmidt & Wrisberg, 2008). To facilitate the learning of a new *piece*, the choreographer should give dancers a limited amount of information and allow them enough time to mentally and physically rehearse this information. The process of rehearsal will help the dancers to transfer the information from short-term memory to long-term memory. This transfer is an indication that the dancers are successfully learning the material. Continued rehearsal will, of course, be needed to further strengthen the memory to the point required for the expected level of performance. The choreographer should keep in mind that some aspects of a movement or sequence might be more difficult to remember than others. For example, if a choreographer asks dancers rehearse a new 8-count repeatedly until they appear to have it memorized, some of the counts might be easily reproduced the next day (i.e., they were successfully transferred to long-term memory) while some others (usually more difficult or complex) won't.

*Memory: Long-Term Memory.* Long-term memory stores information that is held for longer periods of time, such as days, weeks, months, or even years, and can be recalled with little hesitation (Sage, 1984). Generally, the information that is held was heavily rehearsed and meaningful to the person (Sage, 1984; Schmidt & Lee, 2005). Unlike short-term memory, long-term memory is believed to be able to hold an unlimited amount of information, both cognitive and motor (Schmidt & Lee, 2005). As noted earlier, learning is thought to occur when information is transferred from short-term to long-term memory (Schmidt & Wrisberg, 2008). A choreographer can facilitate this task by allowing for extensive repetition of a *step* or *phrase*. Practicing a *phrase* repeatedly will lead "to the development of better and stronger [long-term memory] for movement," and therefore, a dancer will be able recall the information with less effort (Schmidt & Lee, 2005). Choreographed dance is mainly composed of discrete and serial tasks, which can be more difficult to remember because they often include high cognitive demands that require mental strategy and critical thinking (Sage, 1984). Continuous skills are

less difficult to recall at a later time because the action is generally more familiar and occurs more regularly for the participant. Therefore, a choreographer should be aware that *phrases* and *sections* that contain more discrete and serial skills will be more difficult for the dancer to remember, than the sections where the dancer is walking or running. Some dancers are particularly good at remembering certain *steps* and *phrases* even years after they were first learned because the elements were personally meaningful. A choreographer should work to communicate the meaning of *phrases* so that dancers can find some personal connection to the *piece*. Such a connection can create emotion and purpose for that will hopefully help support the transfer of information to long-term memory.

*Forgetting: Warm-Up Decrement.* When a dancer has a break from practice, whether it is a few minutes during a rehearsal or a few days between rehearsals, a choreographer might notice a decline in performance when rehearsal is resumed. This decrement is thought to happen because the dancers need a short amount of time to “‘warm-up’ to the task (psychologically)” before they can perform at their previous level (Schmidt, 1975). A choreographer should expect to see such forgetting and understand that such *warm-up decrement* does not represent a complete loss of the skill. Understanding this aspect of memory will prevent possible frustration when dancers do not perform as well at the beginning of one rehearsal as they did at the end of the previous one. The warm-up decrement concept also reminds the choreographer of the importance of warming up both physically and mentally just prior to the actual stage performance of a *piece*.

Warm-up decrement is thought to occur for two reasons. The first is the idea that memory loss or forgetting occurs (Schmidt & Lee, 2005). Once the choreography is re-presented and re-practiced, the loss in skill decreases. The second describes warm-up decrement as a loss of set, which is “one or more temporary internal states that underlie and support the skill in question” (Schmidt & Lee, 2005). If a dancer were to lose a set, he would not be able to place his body correctly in the *phrases* as well as he did before. The memory of the skill is not lost in this case, but the “postural and attentive adjustments” are slightly forgotten resulting in a decline in performance (Schmidt, 1975; Schmidt & Lee, 2005). Once again, in order to regain the level of performance that was in place before the break, a choreographer must allow a short amount of time for the dancers to “warm-up.”

### *Generalized Motor Program*

The concept of a generalized motor program is essential for a choreographer to understand. It explains how dancers are able to perform a movement that they have never done before; this idea is helpful for choreographers because it means that most dancers will be able to do basically any choreography or movement that is asked of them. In order to fully understand a generalized motor program, it is important to understand what a motor program is.

### *Motor Program*

The first foundational information for understanding a generalized motor program is to understand what a motor program is. A motor program, as defined by Fairbrother is “a set of prestructured commands that specifies the pattern of movement to be completed” (2010). According to original theories, each movement had its own unique motor program, also known as a simple motor program. This would mean that every different movement would have its own

prestructured commands on how to accomplish that movement. There are two issues with this idea; one is a question of storage and the other is a question of novelty (Schmidt & Wrisberg, 2008). If each movement skill and variation of movement skill had its own motor program, then there would be an unlimited amount of motor programs. This would present a problem because the body would have to figure out a way to store instructions for every type of movement possible. The other issue with the idea of simple motor programs is over novelty; if a new skill were to be introduced to a person, how would there be a motor program for it. How would a dancer be able to perform choreography that has never before been done if no commands existed for it previously? Now, the general concept of a motor program is needed to understand why the theory of the generalized motor program is accepted.

### *Generalized Motor Program*

A generalized motor program (GMP) is an abstract memory representation that defines a pattern of movement that is flexible in order to “meet various environmental demands” (Schmidt & Wrisberg, 2008). For example, a common step in dance is the pirouette, which is a turn that involves the dancer turning away from the supporting leg, while holding the working leg in the posse position. A dancer may need to perform a single, double, or triple pirouette. The dancer’s GMP for the pirouette describes the general features of the movement but allows it to be executed in different ways. For example, the relationship between the arm and leg movements of a given pirouette (the general pattern) should look the same even if the speed of the rotation is changed (the flexible aspect). The GMP is thought to include two different types of features, those that do not change (called invariant features) and those that do (called parameters) (Schmidt, 1975). The invariant features are aspects of the movement such as the sequencing of movement components, the relative timing or rhythm of the components, and the relative force used in executing each component. For example, the jeté can be completed in several ways that vary in terms of the magnitude of the leap, but the sequence, timing, and forcefulness of component movements will always be the same. In simple terms, the general pattern of movement is preserved across all of the different forms. This can be easily determined by simply noting that one jeté should resemble another. Otherwise it is not a jete. The parameters are aspects of the movement such as the overall duration or speed. Although the general pattern of movement in the jeté should be preserved, the size of the leap can be changed by varying the parameters related to how fast and forcefully *all* of the component movements are executed.

A choreographer can use the GMP concept to diagnose the types of problems that a dancer might be experiencing in executing certain movements. If one component of a movement does not fit the expected general pattern, then the dancer needs to work on learning or strengthening the appropriate GMP. For example, a dancer might shorten the last step before completing a grand jeté. This indicates that he has not learned how the parts should be related to one another. If instead, the dancer can produce the correct general pattern, but can’t adapt it to a new situation, then he needs to work on learning to scale the GMP (e.g., learning to lengthen a leap). The choreographer should be aware that modifying a GMP can require extensive practice because a previously learned pattern of movement can cause interference. So a seemingly simple problem of taking too short of a step leading into a leap might actually take some time to overcome. For practicing parameter variations that will allow the dancer to scale a movement, the choreographer should give the dancer the opportunity to practice a variety of different parameter demands (e.g., leaps of many different sizes) even some that might never be performed in a

*piece*. Such varied practice is thought to strengthen the *rule* that connects the movement components in the GMP and increases the flexibility in applying it in different situations.

## Information for Working Effectively with Dancers

Every choreographer is presented with the challenge of effectively placing movement on dancers. This challenge can be remedied by understanding how to present information and how to give feedback. This section presents important information that will help the choreographer to have successful and productive rehearsals.

### *Instruction*

The first main task of placing a *piece* is teaching the choreography to the dancers. The choreographer presents the *steps*, *phrases*, and *sections*, and the dancers learn the movements. In order for this process to be most successful, the choreographer should understand different ways to present information to support effective instruction. Three main forms of instruction used by choreographers are verbal instruction, written instructions, and demonstrations.

*Verbal Instructions.* Verbal instructions are commonly used when presenting choreography. A choreographer must instruct the dancers about the type of movements required and the stage locations for those movements. It is essential that instructions are clear and detailed, but also presented in a simple and straightforward manner (Schmidt & Wrisberg, 2008). Choreography is complex, and can be quite difficult to describe. Problems with describing choreography are especially common when presenting *phrases* where dancers are doing different things at the same time. When this problem occurs, the choreographer should, as clearly as possible, describe as much about the movements as possible. This could include how the right arm moves from count one to two, if the left foot is pointed or flexed for a particular jump, where the head is facing, and possibly even the overall description of the quality of movement. It can also include individually describing each dancer's order of *steps*. It may take extra time to break down the movements to this degree, but it will ensure that the choreographer is "on the same page" with the dancers later on. Providing as much instruction as possible for choreography allows the dancer to have a clear view of the movement. It is important to remember, however, that providing too much instruction at one time can overload short-term memory limits. A choreographer will need to determine the "line" of just enough information and too much information.

An effective way to present a desired movement is to use terminology that is easily understood by everyone involved. Each *step* in ballet has a name, which conveys to the familiar dancer exactly what is required. In modern or contemporary dance, some *steps* do not have names because they are unique to the choreographer who created them. In these cases, the choreographer can simply name the *step* or *phrase*. For example, a *phrase* that occurs in the beginning of the *piece* and will become a theme may be termed the "beginning phrase." A *step* that resembles a kung-fu move might be called the "kung-fu step." Giving names to certain *phrases* or *steps* creates a language between the dancer and choreographer, which will facilitate effective instruction. The choreographer should make the language as simple as possible so everyone can easily remember the terminology.

*Demonstration.* Demonstrating *steps* and *phrases* is particularly important for dance instruction. It would be difficult to fully convey the complexity of a choreographed *piece* without demonstration. Effective demonstration should follow certain guidelines (Schmidt & Wrisberg, 2008). First, the choreographer should demonstrate the movement facing the same

direction that the dancers will be facing during the performance. This will help to avoid possible confusion about mirroring or not mirroring the movements. Second, the choreographer should demonstrate the movements *full out*, which means performing correctly and to the fullest extent. The choreographer will also want to engage in *marking*, a process of doing the movement half as large. This might mean a dancer only does arm movements or does everything half as large as the full out movement. Dancers are generally very aware of the placement of their limbs and body; therefore, demonstrations are helpful because they provide a visual tool and description of where the dancers' limbs need to be placed.

*Written Instructions.* At certain points during the rehearsals, verbal instructions and demonstrations may not provide the dancers with enough information. For these situations, a choreographer may need to use written instructions. Written instructions generally supply a diagram of the stage and where the dancer should move across the stage in relation to the other dancers. Not all choreography, however, benefits from written instructions, so each choreographer will need to decide how useful they might be for teaching a given *piece*.

### *Part Practice*

Part practice is a term used to describe a technique of breaking a movement into smaller segments in order to practice more effectively. Choreographers most likely already use this technique, but may not know all of the different ways it can be applied. A choreographer might choose to implement the different types of part practice depending on the specific demands of a *phrase* or characteristics of a certain dancer. Each type of part practice reduced the demands of the to-be learned skill in some way, so they can effectively be used when working with a group or to allow individual dancers work on specific elements of the performance on their own.

*Progressive-Part Practice and Fractionization.* Progressive-part practice and fractionization are two types of part practice that break a movement into parts. To use fractionization, the choreographer would divide a *step* or *phrase* into separate segments and then ask the dancers to practice each segment independently. This can be a good way to isolate a particularly difficult segment and focus more time on it and less time on parts they have already mastered (Schmidt & Lee, 2005). Examples include devoting an entire rehearsal to one *phrase* or asking a dancer to work on one *step* on their own time. To use progressive-part practice, the choreographer would have the dancers work on the first segment in isolation. After a period of time, the second segment would be added to the first and the two would be practiced together. Additional segments would be added in this fashion until the entire *step* or *phrase* is practiced as a unit (Schmidt & Wrisberg, 2008). This type of practice is commonly used when rehearsing choreography and is generally described as “building onto” a *step* or *phrase*.

*Simplification.* As its name implies, simplification requires the choreographer to simplify the movement in some way. One way to do this would be to ask dancers to rehearse only foot movements or hand movements for a particular *phrase*. Other ways include having a dancer practice alone instead of in a formation or rehearsing one formation at a time for parts of the *piece* that call for multiple formations. Simplification can be an effective instructional technique to avoid information overload and the subsequent problems that accompany it. When using simplification, the choreographer should always allow enough time to transition back to performing the actual skills that will be needed during performance.

*Slow Motion.* Slow motion practice involves executing movements at slower than normal speeds. This form of practice would be most appropriate for learning sequences of *steps* and could be accomplished by a “walk through”. Because of the increased time needed, slow motion practice might not be beneficial when learning *phrases* involving eight or more counts. Slow motion practice would also not be appropriate for movements that require a certain speed to ensure that the general movement pattern is executed correctly. For example, a grand jeté cannot be performed in slow motion. Attempting to do so might actually compromise the effort to learn correct technique.

### *Feedback*

Feedback is a critical part of the learning process. In dance, it is often referred to as “corrections”. Feedback comes from one of two general sources. Inherent or intrinsic feedback is information that is normally available to a performer as a consequence of completing a task. For example, a dancer will know if she runs out of space on stage before completing a sequence of *steps*. Extrinsic or augmented feedback is information provided by a person or device. It is not normally available to the performer without assistance. An example in dance would be a choreographer giving feedback about the quality of a dancer’s arm movements during a *step*. This section will focus on extrinsic feedback because that is the source over which the choreographer has the most control.

*Knowledge of Results versus Knowledge of Performance.* There are two broad categories of extrinsic feedback, known as knowledge of results (KR) and knowledge of performance (KP) (Schmidt & Wrisberg, 2008). KR is feedback that provides information about the outcome of a movement. For example, a choreographer may tell a dancer that she missed hitting her mark or that she executed a sequence of *steps* in the wrong order. KR should be used when the choreographer and dancer are working on outcome goals. KP is feedback that provides information about the quality of the movement. For example, a choreographer might tell a dancer that he should slow down his *développé* (extension of the leg) or that his arms were not straight enough during a certain movement. KP should be used when working on process goals. In general, KP will be used more often than KR because dance is so focused on achieving high quality in terms of movement form. The choreographer should remember that extrinsic feedback can sometimes be redundant with inherent feedback. In these cases, additional information provided by the choreographer probably serves little purpose and at times might undermine a dancer’s motivation.

*Properties of Extrinsic Feedback.* Extrinsic feedback has four main properties; it can motivate the learner, reinforce behavior, provide information, and cause dependency. The motivational properties of extrinsic feedback can be helpful when rehearsals are long and tedious or when dancers are struggling with certain movements. An example of motivational feedback is “Great job! You looked beautiful!” Although motivational feedback is likely a common aspect of most rehearsals, its value is so great that the choreographer should continually look for ways to incorporate it when needed. This might be particularly important when other aspects of feedback focus on the shortcomings of a particular aspect of a dancer’s performance. Feedback can also be used to reinforce desired behaviors. Giving feedback after a successful performance will increase the chances that the dancer will perform that movement in the same way (Schmidt & Wrisberg, 2008). Reinforcing feedback can appear to be similar to motivational feedback, but is reserved for times when things went well. Motivational feedback is also used after errors have

been made (e.g., “Good try! With that approach, you will get it eventually.”). An example of reinforcing feedback is “Wonderful job! You really applied the correction I just gave you!” (This statement would also be motivating). It is important not to overuse generic motivational and reinforcement feedback statements as they may lose their value if dancers begin to see them as simply a matter of course.

Extrinsic feedback can also be a very effective means of providing specific information about a movement. This information might tell the dancer what needs to be changed for the next attempt or that the execution was essentially correct and should be repeated in the same fashion. Informational feedback can be used by the choreographer help dancers to make specific changes to their performances. It often provides instructions on how to improve the movement (e.g., “walk with your shoulders back” or “make a bigger contraction on count three”). Informational feedback is critical in helping dancers to refine their movements, but can tend to focus mostly on their shortcomings. For this reason, it is important that the choreographer remembers to select feedback that also serves motivational and reinforcement functions. The fourth property of extrinsic feedback is that it can sometimes lead to dependency. If extrinsic feedback is delivered too frequently (e.g., after every attempt), it will likely prevent the dancer from processing his or her own movement-related feedback (e.g., what the movement felt like). This can cause the dancer to rely too heavily on extrinsic feedback and prevent her from learning to regulate her movements on her own. Performance will then be compromised when the extrinsic feedback is not available such as during the stage performance of the *piece*. Dependency can also be created by using a mirror too often during rehearsal because the mirror provides extrinsic feedback that will not be available during the performance.

*Matching Extrinsic Feedback to Learning Goals and the Dancer’s Skill.* As indicated earlier, it is important that feedback matches the movement goals. For example, if a dancer is having trouble with the general pattern of movement (a GMP issue), then feedback should focus on how to display the desired pattern. According to Schmidt and Wrisberg, program feedback is “feedback that provides error information about the fundamental pattern of a movement (i.e., the generalized motor program)” (2008). This type of feedback is often needed when learning new movements or sequences of movements that are tightly coordinated. A choreographer may give program feedback by saying, “You are not performing the jump correctly; for this jump you must have the front leg bent and the back leg straight.” This correction provides feedback that tells the dancer how to execute the pattern of movement. Even for skilled dancers, program feedback might be needed when working on *phrases* in which transitions between *steps* constitute novel patterns of movement. Once a dancer can correctly perform each *step* and transitions between *steps*, the choreographer will focus more on parameter feedback. For example, a choreographer might tell one dancer to hold an extension longer or lengthen an entire *phrase*.

As dancers develop greater proficiency, the nature of feedback might also change. Descriptive feedback is a type of feedback that supplies the dancer with information about what the choreographer observed. This type of feedback can describe aspects in which the dancer improved or aspects in which the dancer needs to improve. For example, if a dancer performed a *phrase* well, the choreographer may say, “You did a much better job this time, but your third step was still off.” This feedback simply describes what happened. The choreographer assumes that the dancer knows how to correct the third *step*. Descriptive feedback is generally more appropriate for skilled dancers or during rehearsals that are closer to the time of the performance.

Prescriptive feedback, on the other hand, supplies the dancer with information about how to specifically fix whatever was performed incorrectly. The choreographer prescribes the solution to the dancer. This type of feedback may be more helpful for less skilled dancers or when the dancers are first learning the choreography because it provides instruction. For example, a choreographer might say, “Make sure you face more toward the audience during the beginning of the phrase.” The choreographer supplied the dancer with specific information about how to correct or adjust the *phrase*.

*When to Give Feedback.* The final question to address, in terms of feedback, is when a choreographer should give feedback to dancers. A choreographer can give feedback instantaneously, concurrently, or after a delay. Instantaneous feedback is feedback given immediately after an attempt is completed. This type of feedback would likely be detrimental to the dancer because it does not allow the dancer any time to process their intrinsic feedback (Schmidt & Wrisberg, 2008). Although it may be tempting to provide feedback immediately because it appears to save time, it will often undermine the learning process. The choreographer should generally allow dancers enough time to process what a movement “felt like” before providing feedback. One way to avoid the problems with immediate feedback is to intentionally delay the delivery of feedback by some specified amount of time, anywhere from seconds to minutes or even hours after a movement ends. As long as the delay is within reason, the choreographer should not be concerned about degrading learning. The key to an appropriate delay is to pick one that is long enough for the dancers to process their subjective impression of the movement and that fits with the practical needs of conducting the rehearsal. Feedback can also be effectively administered after several attempts (e.g., five executions), which would not only allow the dancer to focus on each attempt, but would give them a chance to form a general impression about their successive performances. A choreographer can also give concurrent feedback, which is delivered during the actual execution of a movement. This type of feedback should be used with caution as it can overload a person’s attention. Because dance is regulated by both vision and hearing (keeping time with the music), concurrent feedback delivered in either modality has the potential to cause interference. In dancing with a partner, however, information delivered through touch might be an effective mode for concurrent feedback.

## Summary

Instruction of dancers is a key component of the choreographer’s role when placing a *piece*. This paper provides a resource for choreographers to make rehearsals more productive. Choreographers need to be aware of certain issues related to movement control and skill learning. The conceptual framework illustrates how teaching a skill may change based on the person, task, and setting. Other foundational information includes concepts related to goal setting and stages of learning. This foundational information provides the framework for understanding more complex and dancer specific information. Understanding what processes the dancer experiences while learning and practicing new choreography may help the choreographer to create a less stressful and more effective rehearsal environment. The choreographer will be aware of different task demands placed on the dancer, such as the demands of memorizing material or determining the best way to focus attention. When running an effective rehearsal, it is essential that the choreographer understands ways to provide instruction and how to structure practice experiences. In addition, providing effective feedback is a critical component of the instructional process that a choreographer needs to understand. All this information will not

guarantee a stress free, perfect rehearsal, but it will help the choreographer move in that direction.

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