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Effects of contextual interference on learning social dance

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**EFFECTS OF CONTEXTUAL INTERFERENCE ON LEARNING
SOCIAL DANCE**

A Thesis

Presented to

The Faculty of the Department of Human Performance

San Jose State University

In Partial Fulfillment

of the Requirements for the Degree

Master of Arts

By

Carolyn Wong

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ABSTRACT

EFFECTS OF CONTEXTUAL INTERFERENCE ON LEARNING SOCIAL DANCE

by Carolyn Wong

The purpose of the study was to test Battig's (1966) theory of memory, specifically multiple processing and contextual variety. It was proposed that two groups of participants, a music and a beat group, be observed. The difference in the learning of three dance patterns were measured. It was predicted that the music context added more complexity than the beat only context. The null hypothesis that a multiple processing strategy and contextual variety would not interact to affect transfer of the cha cha cha was tested. Twelve participants learned to do the cha cha cha in a contextual interference paradigm.

No significant transfer effect was found due to the multiple processing or contextual variety manipulations. The researcher attempted to develop a new measure for social dance. The new measure was not effective in discriminating between the four groups.

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Chapter 1

INTRODUCTION

Theoretical Rationale

Battig's (1966) research on verbal learning tasks was based on his observation of the paradox that practice under blocked conditions enhanced acquisition but impaired retention and transfer, while practice under random conditions impaired acquisition but enhanced retention and transfer. Contextual interference is operationalized in the empirical literature as the influence of random practice on more than one task during an experimental session on retention and transfer. Low contextual interference is created when practice on one task is completed before practicing another task (a blocked practice order). In contrast, high contextual interference is created when all tasks are practiced in an unsystematic sequence (a random practice order). Blocked practice typically results in better performance than random practice during skill acquisition. However, according to Battig (1979) and Shea and Morgan (1979) retention and transfer tests are performed better following random practice.

The contextual interference effect is a memory characteristic where difficult materials to be learned are presented under conditions of high interference will show better long term retention and transfer efficiency than easier materials learned under noninterfering conditions. Battig (1969, 1972, 1979) first observed this contextual interference phenomenon in experiments using verbal materials. Later, Shea and Morgan (1979) observed the same effect in motor skill learning and an enormous amount of attention has been paid to this finding because of its implications for motor skill teaching

and training (see Magill & Hall (1990) for a complete review through 1990).

The theoretical explanation of the interference effect is the manifestation of the interaction of certain groups of cognitive processes to produce the retention and transfer effects observed. Battig's (1979) conceptualization of memory focused on eight cognitive processes that affect learning. These eight cognitive processes are: 1) multiple processing, 2) variable processing, 3) elaboration and organization, 4) distinctiveness, 5) contextual factors, 6) contextual interference, 7) contextual variety, and 8) encoding-retrieval congruence.

In prior studies, researchers have examined the contextual variety dimension of Battig's notions. In the present study, the focus was placed on two aspects recognized by Battig (1966). These two processes are multiple processing and contextual variety factors of learning. Battig defined the multiple processing as "Any item is assumed typically to be encoded in terms of two or more distinguishable mechanisms or processes, which can operate simultaneously and sequentially" (Battig, 1966, p.26). Battig defined contextual interference as factors internal and external to the tasks being performed.

Battig (1979) defined contextual variety as contextual changes within or across repeated encounters with any given item representing a principle source of contextual interference that has the further effect of increasing the contextual independence of the encoding(s) of that item and of facilitating its memory under changed contextual conditions.

In a more complex way to view memory research, Jenkins (1979) used a tetrahedral model of memory. Jenkins' ideas were further developed by Shea and

Morgan (1979) in discussing the contextual interference effect. The four elements Jenkins addressed in memory research were: participants, materials, orienting tasks and critical tasks. Jenkins used the model in a tetrahedral form, or triangular pyramid, whose vertices represent the minimum key components such as participants of the research, orienting tasks, materials, and critical tasks. Participants including the study of abilities, interests, knowledge, and purposes are located at the top of the figure. On the left side are orienting tasks, such as instructions given to the participants, activities performed by the participants, and the various apparatus. Materials representing the task(s) to be performed and the organization or structure over time are located at the bottom of the figure. Finally, on the right side are critical tasks providing observable data when behavior or criterion task is measured. The line connecting any two vertices of the tetrahedron represents a possible relationship, or two-way interaction, between two components. The plane outlined by three vertices represents a three-way interaction, and the whole figure represents the four-way interaction of all the variables. In a real problem the entire tetrahedron must be considered, according to Jenkins. Jenkins reasoned that any relationship connecting any two or three components may be falsified, or possibly reversed, by the changes in one or more of the remaining components. McKeachie (1974) concluded that simple or parsimonious laws of learning and memory were not possible due to the complexity of the memory phenomena and the contextual manner of its determination.

In view of the foregoing discussion, a comprehensive review of context and the memory of motor skills would be an overwhelming task. This thesis was limited to the

investigation of Battig (1979) and his conceptualization of the role played by contextual interference in retention and transfer.

The theoretical explanation of the contextual interference effect is that it is the manifestation of the interaction of certain groups of cognitive processes to produce the retention and transfer effects observed. Battig (1966, 1979) hypothesized that contextual interference and variety elicited an increase in multiple and variable processing of the concurrent tasks in working memory by an individual. Furthermore, multiple and variable processing produces an increase in elaborate and distinctive processing, and processes that produce greater long term retention decrease dependence on memory for retention. Further, the reduction of encoding specificity and dependence of memory on retrieving the original context makes encoding less context-dependent and more likely to be retrieved under new or different contextual conditions such as transfer.

Battig (1966, 1979) thought the increased multiple and variable encoding processes in the learning process lead to the increase in the distinctiveness and elaborateness of the memory presentation for the materials to be learned. Shea and colleagues (Shea & Morgan 1979; Shea & Zimny 1983; 1988) came to the same explanation from their work on the contextual interference effect on motor skill learning. Lee and Magill (1983, 1985) offered a different explanation. Instead they suggested contextual interference increased the processing for a particular skill succeeding variation due to the previous one has been partially or completely forgotten from short term or working memory due to interference. However, Lee and Magill's (1985) finding of increased processing between different variations facilitated the transfer of skill.

This study tested two elements of Battig's (1966) cognitive processing of learning; ie., the multiple processing and contextual interference with regard to learning. Four groups of participants were tested, a music group and a beat group, was crossed with a blocked and random group. Each of these groups was observed to determine any differences in the learning of three dance patterns measured. It was predicted that a context with music added more complexity than a context with the beat only. Due to the recent popularity of dance, a need to further test these theories and strategies could prove useful in the field of motor learning and physical education.

Statement of the Problem

The cha cha cha is the most popular of all the Latin-American dances (Silvester, 1993). The cha cha cha name originated from the islands of the West Indies after certain plant seed pods called cha-cha. Depending upon the island, it is also known as, tcha-tcha or kwa-kwa. The cha cha cha was introduced to the United States in 1954, and dance studios have reported it to be their most popular dance (Stephenson & Iaccarino, 1980). The dance pattern is a Cuban innovation of the old basic Latin form danson. The cha cha cha dance is said to be a combination of the Mambo and American Swing. The rhythm is in 4/4 time, and has an uneven beat pattern of slow slow quick quick slow and counted as 2 3 4 and 1 (Harris, Pittman & Waller, 1988). However, in beginning classes it can also be counted and known as: 1) 1 2, 1 2 3, 1 2, 1 2 3; 2) forward rock, cha cha cha, back rock, cha cha cha; or, 3) slow slow, quick quick slow, slow slow, quick quick slow.

People all over the world dance for different reasons, but for whatever reasons they do, dance is a physical activity accepted across cultures (Rice & Hutchinson, 1952).

High enrollment numbers and anecdotal evidence from students in previous dance classes suggest social dance is a very popular activity today among the younger generation, age group 20-30 years. Through personal communication, it was discovered that many people wanted to learn social dancing just so they can dance at celebrations such as weddings, parties, or enhance socializing, and to meet new people.

This study tested two aspects of Battig's theory, the multiple and variable processing while learning to do the cha cha cha dance. Contextual interference was studied to facilitate the learning of three dance patterns in the dance of cha cha cha.

1. How does a multiple processing strategy and contextual variety affect transfer of three dance patterns of the cha cha cha?

Hypotheses

The following null hypotheses were tested:

1. Multiple processing and contextual variety would not interact to affect transfer of the cha cha cha.
2. Multiple processing would not affect transfer of the cha cha cha.
3. Contextual variety would not affect skill transfer of the cha cha cha.

Delimitations

The study will be delimited to:

1. Participants who were recruited from the Psychology and Human Performance Department in a large metropolitan University. They were all 18 years of age or older.
2. Volunteers who have little or no cha cha cha dance experience.

Definition of Terms

Contextual interference is defined as the influence of practice on more than one task during an experimental session. It is the interference that occurs across repeated trials on any substantial amount of interference produced by the context of other items and the ways these items are processed. Contextual variety is defined as the influence of practice on more than one task during an experimental session and is usually operationalized as blocked and random practice orders. Multiple processing is defined as any item that is assumed typically to be encoded in terms of two or more distinguishable mechanisms or processes, which can operate simultaneously as well as sequentially. For the purpose of this study the modeled foot pattern was measured. This code or cognitive plan serves to guide the overt performance. The cha cha cha is defined as a Cuban innovation of the old basic Latin form danson. The cha cha cha is said to be a combination of the Mambo and American Swing. The cha cha cha has a 4/4 time and an uneven rhythm beat pattern of slow slow quick quick slow. It is usually counted as 2 3 4 and 1. However, these same steps are referred to in a beginning class as 1 2; 1 2 3 and 1 2, 1 2 3; 1 2, cha cha cha, 1 2, cha cha cha; or forward rock, cha cha cha and back rock, cha cha.cha.

Importance of the Study

No application of Battig's (1966) contextual interference theory has been made specifically in a social dance context. Although applications of contextual interference have been made in other aspects of physical activities it has not been done in dance. Most studies reported in the literature on contextual interference focused on variable

processing concepts. Researchers that have focused on variable processing include Magill and Hall (1990) and Shea and Morgan (1979). Additional studies that have led to similar results were studies done by (Del Rey, Wughalter, & Carnes, 1987; Hall, Domingues, & Cavazos, 1994; Jarus, Wughalter, & Gianutsos, 1997; Shewokis, 1997; Smith, 1997; Wrisberg, 1991). These findings of contextual interference have never been applied in the area of social dance.

This study examined the idea of multiple processing. Battig (1979) defined multiple processing as any item that is assumed typically to be encoded in terms of two or more distinguishable mechanisms or processes, which can operate simultaneously as well as sequentially. The present study applied the contextual interference effect to the learning of the cha cha cha dance. If the multiple processing component proves to be effective, it will allow people to learn dance skills more efficiently and effectively, transfer the learning of skills to other aspects of life, and enrich the whole community.

From an ecological approach, there is a need to further test contextual interference in real world situations. Due to the recent popularity in dance, Battig's (1966) theories and strategies should be tested in social dance to see if they could prove useful in the field of physical education and movement science. If these strategies are proven to be applicable in dance, it could improve methods of teaching, facilitate and enhance the learning of dance patterns as well as variations, and make learning how to dance more enjoyable worldwide.

Chapter 2

REVIEW OF LITERATURE

History of Dance

Dancing has a more important place in primitive society than in any other movement activity. Dance is the only physical activity that is accepted across cultures as a form of exercise and movement activity (Rice, Hutchinson, & Lee, 1969). During primitive times, the main purpose of dance was to evoke good will and help sanctify the demons. Dancing during primitive days was a serious and usually religious activity. The leading forms of primitive dance were initiation dance, war dance, dramatic performance, and exorcising of spirits (Rice & Hutchinson, 1952). Women in some tribes were known to continue their dancing during the battle as a means of imploring victory. If the battle was successful a dance of celebration and thanksgiving followed the battle. Dancing was regarded as the most effective method of exorcising evil spirits. Dance was used by the wizard, medicine man or woman as a means to heal the sick. The gods were worshipped during the early times by very large groups of dancers (Rice & Hutchinson, 1952). Dance was also used as the medium for communicating with the gods and influencing the invisible world. Dance played a very important role in the lives of early people.

As a series of light exercises, the Chinese practiced Cong Fu which resembled the Swedish Ling system. The Chinese believed that diseases were derived from inactivity of the bodies. Therefore, mild forms of medical gymnastics, combined with stretching and breathing exercises, were designed to maintain organic functioning, and to prolong human life. The Chinese were the first to incorporate dance as a physical activity and used it to

improve health. These medical gymnastics known as Cong Fu were usually performed in a standing, sitting, or kneeling position (Van Dalen, 1953).

Contextual Interference Theory

Battig's (1966) research on verbal learning tasks was based on his observation that practice under blocked conditions enhanced acquisition, but impaired retention and transfer; while practice under random conditions impaired acquisition, but enhanced retention and transfer. Contextual interference has been operationalized in previous studies as the influence of practice on more than one task during an experimental session on retention and transfer of the practice. Low contextual interference is created when practice on one task is completed before practicing another task (a blocked practice order). In contrast, high contextual interference is created when all tasks are practiced in an unsystematic sequence (a random practice order). Blocked practice typically results in better performance than random practice during skill acquisition. However, according to Battig retention and transfer tests are performed better following random practice.

The theoretical explanation of the contextual interference effect is that it is the manifestation of the interaction of certain groups of cognitive processes to produce the retention and transfer effects observed. Battig (1979) conceptualized memory focused on eight cognitive processes that affect learning. These eight cognitive processes are: 1) multiple processing, 2) variable processing, 3) elaboration and organization, 4) distinctiveness, 5) contextual factors, 6) contextual interference, 7) contextual variety, and 8) encoding-retrieval congruence.

In prior studies, researchers examined the contextual variety dimension. However, in the present study, the focus was placed on two other aspects of Battig's cognitive processes. These two processes are multiple processing and contextual variety factors of learning.

Battig defined the multiple processing as "Any item is assumed typically to be encoded in terms of two or more distinguishable mechanisms or processes, which can operate simultaneously and sequentially" (Battig, 1966, p.26). Battig defined contextual interference as

"Especially across repeated trials in the typical list-learning experiment, any given item is subjected to varying but often very substantial amounts of interference produced by the context of other items and the ways in which they are processed. Items subjected to minimal contextual interference may require little processing to meet the task requirements, but this processing may be insufficient for them to be remembered after a long retention interval. Items subjected to larger amounts of contextual interference require more processing, are learned more slowly, and within most experimental paradigms may receive insufficient processing to be learned and remembered as well as those easier items with less contextual interference. Items learned well enough to overcome this contextual interference, however, typically are remembered as well as or better than under low-interference conditions" (Battig, 1966, p. 26-27).

In a more complex way to view memory research, Jenkins (1979) used a tetrahedral model of memory, and contributed ideas of the contextual interference effect.

The four elements Jenkins addressed in memory research were: subjects, materials, orienting tasks and critical tasks. Jenkins believed a more complex theoretical framework is required for the understanding of memory. According to Jenkins (1979), a minimum of four elements are needed in the framework: subjects, learning material, tasks performed by the subjects, and tests of learning.

The theoretical explanation of the interference effect is that it is the manifestation of the interaction of certain groups of cognitive processes to produce the retention and transfer effects observed. Battig (1966, 1972, 1979) hypothesized that contextual interference and variety elicited an increase in multiple and variable processing of the coexisting tasks in working memory by the individual. Furthermore, multiple and variable processing produced an increase in elaborate and distinctive processing, processes that produce greater long term retention by decreasing dependence on memory for retention. The reduction of encoding specificity and dependence of memory on retrieving the original context by making encoding less context-dependent and more likely to be retrieved under new or different contextual conditions.

Empirical Investigations of Contextual Interference

Multiple empirical investigations of the contextual interference effect have been conducted since the early work of Shea and Morgan in 1979. Del Rey et al., (1987) investigated the effects of contextual interference on memory and transfer using tasks of coincidence anticipation. Participants had to predict the arrival time of a light stimulus. Their study investigated forgetting hypothesis proposed by Lee and Magill (1985), i.e.,

that forgetting the cognitive processing steps in the performance of a task would facilitate retention.

Seventy-two right-handed female volunteers were selected to investigate the effects of the practice session on acquisition, retention, and transfer of tasks requiring coincident anticipation. All participants were required to complete an activity questionnaire determining the extent of experience in open sport skills. Two levels of experience were selected. The experienced group consisted of those who at the time of testing had regular involvement in open-sport skills and had been regular participants in their sport for at least five immediately preceding years. The less experienced group were those who at the time of testing were not involved in an organized open sport and had been involved, if at all, no less than five years ago for a maximum of two years.

This study used a Bassin Anticipation Timer with three 16-lamp runways. The required task was to depress a button coincident with the arrival of an apparently moving light. A warning light illuminated before the travel of the moving lights and served as the signal to watch for the movement of the lights. There were a total of 64 acquisition trials administered to all participants in four 16-trial blocks.

Del Rey et al., (1987) indicated that the level of expertise affected acquisition, retention, and transfer with striking similarity. They reported the following findings: 1) the less experienced participants responded with more error and more variability than the experienced participants; 2) the less experienced participants responded with more error and more variability than the experienced athletes in all testing phases of the experiment; 3) experts responded with significantly less error and less variability than the less

experienced participants in both retention and transfer; 4) experts who learned the tasks in the variable as well as the blocked-acquisition groups were more accurate in transfer than the less experienced participants in their respective acquisition groups. In their study, expertise was a major factor in explaining the transfer results, not contextual interference.

Carnahan et al., (1990) tested the impact of separate movement and timing tasks on the superior learning of random trained groups. Participants consisted of 48 right-handed undergraduates. Sixteen males and 32 females with a mean age of 20 years from the University of Waterloo served as participants. These participants were randomly assigned to one of four groups. Each gender was equally represented in all four groups. All participants in the study received course credit in exchange for their participation.

The four groups consisted of: 1) no movement, blocked; 2) no-movement, random; 3) movement, blocked; and 4) movement, random. Each of these groups were required to learn three different patterns of the cha cha dance.

The task for all participants in the movement condition was to release a start button and knock over a wooden barrier. This specific task involved three movement time goals to be learned. Half of the participants in this movement condition practiced the three movements in a blocked schedule and the other half practiced in a random schedule. Following the blocked and random schedule, both groups performed a retention test.

Carnahan et al., (1990) reported that their findings supported the notion that movement generation is necessary to find the contextual interference effect. They stated that the contextual interference effect between the superior blocked group performance during acquisition and superior random group performance during retention was found

only for the movement condition. Their data showed that for the movement condition, the blocked group performed with less error than the random group during acquisition. No similar differences between the two practice schedule groups were found in acquisition for the no-movement condition. However, in retention, the random group performed with less error than the blocked group. On the other hand, for the no-movement condition, there were no differences between the two practice schedule groups during acquisition or during retention for any of the dependent measures. These results indicate that experimental tasks must have some type of movement requirement in order to expedite learning through the use of random practice schedules.

Wrisberg (1991) made an attempt to determine whether contextual variety could be easily incorporated into a physical education class setting and whether it produced a significant influence on final skills-test performance. There were 16 male and 16 female participants. These participants were from a beginning badminton class at the University of Tennessee at Knoxville. "The badminton tasks were the clear (or long) service and the short service. All serves were practiced and tested on a regulation court. Participants used a regulation racket and plastic (Carlton blue stripe) shuttlecocks" (Wrisberg, 1991, p.24). The experiment consisted of two phases, a practice phase and a test phase. During the practice phase, participants performed 18 short serves and 18 long serves. During the test phase, participants performed 12 short serves and 12 long serves in a blocked fashion with order counterbalanced within each group. All test results were recorded. Participants performed a total of 108 trials with each serve during the practice phase. During the test phase, participants performed 12 trials with each serve. The only

knowledge of results available to the participants in either phase was their vision of the location of the shuttlecock's landing point.

Four practice schedules different in the amount of contextual varieties were administered during a regular college physical education class. Beginning badminton students were matched for skill level and practiced the long and short serves according to their particular conditions at the beginning of each of the six class periods. Students monitored each other's practice sessions without significant alterations in normal class procedures. Standard skills tests which were administered at the end of the semester revealed that the short-serve performance of the group receiving the highest level of contextual variety during practice was significantly superior to that of two of the other three conditions.

The results of this study indicated that retention of the badminton short serve is facilitated for subjects who have received previous practice with a greater variety of movements in a non repeating fashion. Additional significance is the finding of higher retention for the group that practiced three versions of each serve in a repeating manner. A different movement from trial to trial during the acquisition phase suggests support for the notion that the benefits of contextual interference are linked to the need of action plan revisions during training. It appears that the number of serve variations attempted during practice may not have been as crucial to the development of the short serve as was the requirement to do something different on successive trials.

Bortoli et al., (1992) examined the possibility of generalizing effects of contextual interference on retention and transfer, verified by laboratory tasks, to the activities carried

out during physical education classes. The skills considered were the technical skills of volleyball bump, volley, and serve. These tasks were placed in a learning context that takes into account the actual school situations of high school students. Furthermore, the learning objective was not so much the correct execution referred to an ideal technical model but the accuracy of hitting a target.

Four groups of students in the 9th grade, 91 students, participated in the first phase of administration of the tests. Each group was then randomly assigned to one of four treatments. Blocked, random, serial, and serial with very high interference groups. Of the initial 91 students, 52 were then chosen, with 13 students per group.

Eight lessons were administered to each experimental group, one lesson a week, during a two month period. The first session was for initial testing on the fundamentals of volleyball. During the following six meetings, the students practiced the technical elements in ways that differentiated for each group. The final retention and transfer tests were administered during the last session.

Bortoli et al., (1992) found significant differences among the four experimental groups in the long transfer situation for the serve. This test, was more difficult than all the others; the two groups given random and serial practice achieved performances superior to those of the other two groups who had blocked practice and serial practice with high interference. It was stated that a consideration that could explain lack of significant differences among the groups on retention tests, is related to the characteristics of the skills practiced. Since emphasis was placed on the accuracy of the ball's trajectory more than on the correct execution of the movements, the task actually may have consisted in

learning variations of a task governed by the same motor program rather than of skills controlled by different programs. It appeared that these characteristics of the task could have reduced or hidden the positive effects of contextual interference. Significant results emerged for the long transfer position with the serve, in which the similar random and serial practice groups showed better performance than did those with blocked and serial practice with high interference. Situations of too high contextual interference, vice versa, tend to hinder verification, repair, and adaptation of the skill to the demands of the task that the participant executes between one attempt and the next. It is probably for this reason that the serial group with high interference did not improve on the serve at the long transfer relative to the blocked group, as instead happened to the other two groups given serial and random practice.

Blandin et al., (1994) explored the idea of whether observation of an model learning a timing task enables the observer to develop a cognitive representation of the task similar to the one acquired through physical practice. To reach their goal they tested whether a contextual interference effect would be obtained in a retention test of participants who had observed an individual practicing three variations of a timing task under a random or a blocked schedule of practice.

Eighty-four undergraduate students who enrolled in a first six-year class of psychomotor behavior participated in this experiment for a course bonus. The mean age was 22 years of age. They were randomly coupled two by two and then randomly assigned as models or observers when arriving at the laboratory.

The task involved three movement patterns. Each of these patterns had to be completed in a fixed movement time. There were two experimental groups. The first group was a group of models who only practiced the task physically. The second group, called observers, sat beside and watched a model learn the experimental task. The visual and the auditory cues associated with the model's performance were available. Participants' tasks were to learn each of the three movement patterns described above under either a blocked or a random practice schedule.

The results indicated that the observation of a model learning a timing task resulted in a decrease in the amount of physical practice with knowledge of results required to attain a plateau in performance. Regarding contextual interference and learning, the results obtained for the observers in the second experimental phase of the study indicated that this effect indeed has its roots in the cognitive processes that take place prior to movement realization. Finally, the fact that the schedule of practice used by the participants during the first three experimental phases did not affect their performance in the last two retention tests suggests that, under some circumstances, sufficient practice can overcome the disadvantages associated with blocked practice.

Hall et al., (1994) tested the effects of the learning benefits of contextual interference with skilled athletic performers in different settings. This experiment tested the generalizability of the effects of contextual interference for skilled athletes in a sport setting. Specifically, they tested the effects of different practice schedules on biweekly additional batting-practice sessions for a junior college baseball team.

The participants were 30 male baseball players from a junior college baseball team in California. The participant's ages ranged from 17 to 21 years with an average of 19.5 years of experience in competitive baseball. The selected task was to hit three different pitches solidly. The pitches were change-ups, fastballs, and curveballs. The assignment procedure was determined through a master list of the 30 players ordered from most skilled to least skilled at hitting using three criteria. The criteria entailed were the pretest score, current batting averages, and a subjective list prepared by the head coach. The players received 45 change-ups, fastballs, and curveballs according to a predetermined random list. The same assistant coach pitched for both the pretest and the transfer tests on a live playing field. The responses of the pitches were evaluated by two separate judges as either a solid hit or not a solid hit. These two judges were baseball coaches and were used consistently during the entire experimental procedure. Players were instructed to strike at good pitches only, the pitches were recorded only when contact was made.

Different amounts of learning or improvement were attained in the different experimental conditions. In a high contextual interference practice schedule, random presentation of pitches, led to greater improvement in hitting three different types of pitches than a low contextual-interference practice schedule, blocked presentation of pitches. Also, neither of these additional batting-practice schedules led to greater improvement than regular batting practice. These findings confirm and support the generalizability of the laboratory demonstrations of the contextual interference effect of earlier research. This particular study found that random practice was more effective for batting practice.

Hebert et al., (1996) investigated the influence of student ability on practice schedule effects within a physical education setting. A secondary purpose was to explore the task similarity factor by employing two skills, tennis forehand and backhand ground strokes, that required different motor responses yet had similar perceptual and timing characteristics. It was predicted that a communication between practice schedule and student skill level would be observed. That is, low-interference practice would enhance the learning of low-skilled students, whereas high-skilled students would benefit more from practicing motor skills under a high-interference schedule.

Participants in the study were undergraduate students. These participants consisted of 38 women and 45 men who registered in five beginning tennis classes. The forehand and backhand ground strokes were selected as the experimental tasks. Participants performed 30 ground strokes: 15 forehand and 15 backhand ground strokes. Participants were assigned to two groups, either blocked or alternating groups. Participants assigned to the blocked condition completed all forehand strokes followed by all backhand strokes, whereas those assigned to the alternating condition alternated forehand and backhand strokes on each trial. All trials were scored as either successful or unsuccessful. The successful trials were defined as those on which the ball passed over the net and landed in the backcourt. In addition, each student recorded the amount of time they spent practicing or playing tennis outside of the class. It was expected that variations in out-of-class tennis activity could influence the results and should be documented.

The results found that high-interference practice of these dissimilar tasks failed to facilitate learning, even for the higher skilled learners. Herbert et al., (1996) clearly stated that further research on the influence of task complexity and the nature of task variations on practice scheduling effects are required. Their results suggested that high-interference practice conditions are counterproductive during the early stage of skill learning. Rather, novices should be allowed to experience repeated attempts of a task under low-interference conditions. Previous research on teaching in physical education has demonstrated that student ability level significantly affects motor practice and achievement. Their results demonstrated the importance of student ability in evaluating the effectiveness of practice conditions and provides an example of how information regarding the effects of entry skill level can be used by instructors to effectively structure the learning environment.

Sekiya et al., (1996) identified two purposes for their research. The first purpose extended the experiment of their previous study of Sekiya et al., (1994) by investigating whether modifications of the overall force parameter would localize the contextual interference effect in parameter learning. The second purpose was to examine the influence of the amount of practice on the contextual interference effect for learning task variations controlled by the same generalized motor program. Participants practiced task variations that required overall force parameter modifications in either a blocked (low contextual interference) or a serial (high contextual interference) condition.

Twenty-four university undergraduate students volunteered to participate. Participants consisted of 12 men and 12 women. None of the participants had prior

experience with the task. The selected task was to produce spatial-temporal movement patterns on a computer screen by moving a computer mouse with the preferred hand. While seated in front of the device, participants were asked to move the mouse in a three-segment, forward-backward-forward movement in the horizontal plane along a linear track that was placed on a tabletop at waist level. Participants in the blocked acquisition condition completed 90 trials on one task variation before another variation was introduced. The participants in the serial acquisition condition performed the 270 trials in 90 identical triplets of the three task variations. Half of the participants in each acquisition condition were randomly assigned to either a blocked or serial retention test condition.

Each pair of acquisition retention conditions had an equal number of male and female participants. The participants in the blocked retention test condition performed the 30 trials in 3 blocks of 10 trials. The participants in the serial retention test condition performed the 30 trials in 10 triplets of 3 trials. The order in which the task variations were performed was identical for the two acquisition sessions but counterbalanced with a Latin square design across the participants for each pair of the acquisition-retention conditions. The order of task variations in the retention sessions was identical to the order in which the task variations were introduced in the acquisition sessions (Sekiya et al., 1996, p. 61).

The results showed that general performance during retention was enhanced by a high level of contextual interference during acquisition. While there were no group differences in acquisition, this same result was consistent with a number of experiments investigating the contextual interference effect. The most important aspect of contextual

interference is the group difference in retention because it is this test that reflects the amount of learning promoted by the various levels of contextual interference in acquisition. The significance of finding the contextual interference effect for the general performance measure is that it supports Sekiya et al.'s (1994) finding that retention of task variations controlled by the same generalized motor program was enhanced by high contextual interference practice. However, it clearly contradicts the Magill and Hall (1990) study where they hypothesized and predicted no contextual interference effect for task variations from the same generalized motor program. Sekiya et al., suggested more research is necessary in order to clarify the discrepancy between the retention and transfer findings.

Brady (1997) examined the contextual interference effect on teaching golf skills in a naturalistic setting to 2 groups of 18 novice golfers. These undergraduate students practiced four foundational skills under conditions of low and high contextual interference, separately. The purpose of the study was to assess whether blocked or random practice was more effective in teaching golf skills.

The participants were 36 undergraduates, 22 men and 14 women. Participants were enrolled in two beginning golf classes at Long Island University. One class was designated as the random group (high contextual interference) while the other was labeled the blocked group (low contextual interference). As the groups enrolled in the class in different semesters, random assignment was not possible. The middle distance iron, drive, pitch, and chip shots were selected as being foundational and different skills in golf. For the drive shot, participants were required to drive the ball off the tee with either a one or a

three driver for maximum distance. Participants used the five, six, and seven iron clubs for middle distance shots. They were required to hit the ball off the ground in the direction of cones arranged at 120, 130, 140, 150, and 160 yards, separately. Participants were free to choose the club and the distance for this skill. For the pitch shot, participants used an eight, nine or pitching wedge to hit the ball at cones placed at 30-, 40-, 50-, 60-, and 70-yd. distance. The student was free to choose the club and the distance for this skill. For the chip shot, participants practiced chipping the ball from a distance of 10 to 15 yards to a cone with any of the irons. All participants had an equal number of attempts with the different skills.

The results showed no difference between the random and blocked groups. It was suggested that it is possible that the number of trials were too few to generate a support for the contextual interference effect. It is also possible that some of the skills may have improved with contextual interference. However, as the dependent variable was a combined score for the four skills, it was not possible to estimate whether there was a differential effect for any of the skills. Practicing four skills may also have introduced too much interference.

Jarus et al., (1997) investigated the optimal practice schedule during acquisition to facilitate retention and transfer under different conditions of movement tasks. They included a computerized task presented in two conditions of movement task, an open-task condition and a closed-task condition to differentiate between the influences of the blocked and random practice schedules.

Participants consisted of 74 healthy women with no varsity athletic experience either during the time of the study or for one year immediately preceding the study. The criteria for this selection was based on self-report, and excluded anyone having known neurological or biomechanical impairment, hearing or visual abnormalities, a history of damage to the central nervous system, or failure to provide informed consent. The task of the participant was to track the cursor through movements of the head, from the starting position until the target reached its final position. Participants performed a tracking task by moving their heads while watching a 16-in. computer-generated video display containing a blue cursor and a red target. A device was attached to the head of the participant to monitor their head position. Nine trials were administered in the transfer pretest phase. Participants performed three trials for each pretest task; these trials were presented either in a random or a blocked practice schedule. Pretesting was done using the split-halves method. One half of each group having the blocked and random acquisition trials was pretested using a blocked practice schedule, and the other half was pretested using a random practice schedule.

The results provided partial support for the predictions of contextual interference theory. In the acquisition phase of the experiment participants on a random practice schedule were more fluctuating than those on a blocked practice schedule. The conditions of contextual interference during acquisition on performance during retention were not supported. There was also no support for the interaction of practice schedule and condition of movement task as was predicted. Participants learning under open-task conditions performed better during retention and transfer than participants learning under

closed-task conditions. This supports the prediction that learning in an unpredictable context that requires elaboration will be more beneficial for retention and transfer. This study suggests that there are various factors that may contribute to context effects.

Pollock and Lee (1997) investigated the effects of random and blocked practice on performance by children versus adults to determine a clear dissimilarity between the two. Because of the differing results among the studies in comparison to the adult findings, these age groups need to be evaluated using the same experimental design, using the same task and procedures.

Participants included 24 7-year olds and 24 adults. The group of 7-year olds included 14 boys and 10 girls. These participants were from a summer sports school held at McMaster University. The adults were from a graduate course at McMaster. Participants were randomly assigned to either a random or a blocked practice group, with the only restriction that group membership was balanced by sex.

The results of this study found that the pattern of contextual interference effects found often for adult participants were replicated in this experiment. Blocked practice resulted in better acquisition performance than random practice and tests of retention and transfer were performed better after practice had been conducted in a random order. This pattern of results was only partially true for the children. Children given random practice performed better than those given blocked practice on both the retention and transfer tests. For acquisition however, the random and blocked groups were equivalent for the children. For the children in the study, the advantage of random practice occurred in the absence of differences between practice orders during acquisition performance.

Shewokis (1997) tested contextual interference effects in a nonlaboratory setting. The purpose of the study was to examine contextual interference in a nonlaboratory setting using tasks from a computer game which require fine perceptual motor skills and are of a longer duration than other tasks traditionally used. Shewokis studied the generalizability of contextual interference to computer games. The research question posed for this study was “Is the contextual interference effect generalizable to computer games when acquired and tested in a real world setting?” (Shewokis, 1997).

Participants were randomly assigned to one of two groups, blocked or random. Participants were undergraduate Kinesiology and Sport Management majors at a Midwest University. Participants received credit in the course for taking part in the experiment however, they were not required to participate. Each group consisted of nine men and three women.

The tasks selected (a) used fine motor control, (b) involved a moderate amount of cognitive effort, (c) were continuous in nature (tracking), and (d) were novel to the performers. The computer software used was, “The Games: Winter Challenge” by Accolade, version 3.11 of the Window system on IBM computers. The selected tasks in the computer games were five events: bobsled, ski jump, speed skating, lunge, and cross-country skiing.

Two predictions were made for contextual interference during acquisition. The first was that the blocked group would perform better than the random group. The second, random performance would be equivalent to that of blocked at the end of acquisition. Neither predictions were supported in the study. The acquisition results are

similar to those found by Lee and White (1990) who also used computer games as tasks. More permanent evidence of learning was found in this study when testing for retention and transfer. Transfer effects were found which supported contextual interference predictions. Participants who learned the bobsled, speed skating, and lunge events in a random practice schedule performed the transfer cross-country skiing event faster than those participants who learned the events under a blocked practice order. It was suggested that more work is needed to concentrate on exploring the specifics of task characteristics, especially from the perspective of the performer and the effects of these characteristics on the memory and transfer of skills.

Smith (1997) hypothesized that this increase in task difficulty during practice would be associated with a high attention load during practice. His hypothesis was supported, however, high contextual interference promoted only a temporary increase in retention.

Participants of this study consisted of 29 men and 28 women from the University of Houston. Participants were from undergraduate activity classes who volunteered to participate in the study. Participants' ages ranged from 18 to 34 years.

The task consisted of steering the cursor along a straight path 3/4-in. wide, which was tilted at one of four angles clockwise from vertical (30, 60, 120, 150 degrees). The path extended across the diameter of a 6-in. circle, and the cursor began each trial just within the circle on the left-hand side of the path. For each trial the cursor had to be guided to the opposite end of the path and back again, after which the total time taken was presented at the top left-hand corner of the screen. If at

any point the subject did not keep the cursor within the path guidelines, the path of the cursor became invisible and remained invisible until the cursor reentered the path. In addition, the experimenter ensured that subjects were attempting to guide the cursor within the path, in which case bimanually coordinated movement was needed to maintain control of the cursor. Subjects' reaction times to an auditory stimulus were also assessed at times during the experiment. The auditory stimulus was randomly presented within the fourth and eighth seconds of each relevant trial. Each subject reacted to the stimulus by raising the right foot from a foot switch on the floor. Subjects were then randomly assigned to one of four experimental groups. These were (a) low contextual interference, (b) high contextual interference, (c) spacing of repetitions, and (d) intertask processing. (Smith, 1997, p. 85-6).

The primary hypothesis of the study was that the group with low contextual interference would perform worse at retention than the other three practice groups and that this inferior retention performance would be associated with accordingly lower on-task attention during acquisition than the other three groups. On all subsequent trials there were no performance differences among the four groups, and there was no relationship between retention performance and probe reaction time during acquisition. Whereas previous investigations of the effect of contextual interference have used discrete tasks, the task used in the present study was continuous. One unexpected result was the finding that the group given practice with spacing of repetitions appeared to find practice less demanding than those given either high contextual interference or intertask

processing. There was limited support for the effect of contextual interference found, and this was attributed to the continuous nature of the task. Evidence was presented which suggested that practice schedules similar to high contextual interference were more attentionally demanding than that of low contextual interference. Smith suggested that this is a promising result which should be further investigated using discrete tasks

Summary

Research on contextual interference shows that learning that requires demanding cognitive processing inhibits learning initially but then produces better retention and transfer. Contextual interference manifests itself when learning contextual varieties, such as, changes in the tasks, practice conditions, and the learning processes. It is believed that such contextual variety induces deeper, complex, overlap, cognitive processing which in turn lead to enhanced learning. Since the contextual interference effect first observed in 1956 by Battig in verbal learning, researchers have reproduced the effect across the learning domain: in verbal memory, cognitive tasks, and motor learning. Research presented above suggests that contextual interference enhances learning and performance both in laboratory and real-world settings such as physical education classes (Wrisberg, 1991), volleyball classes (Bortoli et al., 1992), and golf in a natural setting (Brady, 1997). The contextual interference effect was also observed to applied to adults and children (Pollock and Lee, 1997), to skilled baseball players (Hall et al., 1994), and to high skilled and low skilled tennis players (Hebert et al., 1996). However, contextual effect was more effective on higher skilled subjects than lesser skilled (Del Rey et al., 1987). Furthermore,

contextual interference effect could be generalized to enhance learning of computer games and computer tasks (Jarus et al., 1997; Sheworkis, 1997).

The research presented above also suggests sources of contextual interference and variety. Observers watching high contextual timing tasks learned better than observers watching low contextual tasks. Combination of observation and physical practice produced even better learning (Blandin et al., 1994; Carnahan et al., 1990). Therefore, movement is a good source of contextual variety and it is believed that variations of the amplitudes and acceleration components of the motor program produced variety, which resulted in contextual interference (Sekiya et al., 1996). Thus continuous movement would maximize variety in motor programs (Smith, 1997).

Research summarized above clearly suggests that contextual interference enhances learning and performance of tasks ranging from complex cognitive to high level of motor performance. This thesis focuses on applying contextual interference to the teaching of ballroom dancing .

Chapter 3

METHOD

This study tested Battig's (1966) ideas regarding contextual interference in a social dance context. According to Battig, if a difficult context is provided initially in the learning process then retention and transfer will be facilitated. The Latin dance selected for this study was the Cha Cha Cha. The study investigated if increasing levels of interference during learning would affect motor skill retention. The methods chapter is subdivided the following sections: pilot study, participants, instruments, tasks, procedures, design, and analysis of data.

Pilot Study

A pilot study was conducted to test the dependent measure of social dance used in the study. Further the operational definitions of contextual interference were tested for this context. One male subject was tested.

The pilot study was conducted in the Motor Behavior Laboratory in the Spartan Complex at San Jose State University. It was found that the carpet in the laboratory inhibited the turns required for the steps. It was determined that the primary study would be conducted in a gymnasium or on a floor that would permit better turns than a carpeted floor.

The pilot study also assisted with the angle of placement of the video camera. It was determined that the best angle to view the performance would be from the back of the participants.

Participants

The participants were 12 male students who had little or no previous experience with the Cha Cha Cha dance. At the time of the study they were students at a state university in a large western city. Participants were 18 years of age or older. All participants signed a consent form approved by the SJSU Institutional Review Board (Appendix A).

Instruments

Participants' performances were evaluated by videotape recorded from a VHS system. The video recorder was set on a tripod aimed at the participant's feet. The recorder taped the participants from a back view and recorded their ability to reproduce three dance variations while attempting to stay on beat with either the beat or a music tape. The videotape was played at normal speed in order to collect and record the data. All participants were tested individually.

Tasks

The task used for this study was to learn the basic step and two other variations of dance patterns for the Cha Cha Cha dance. The component skills required included: the basic step, cross over breaks, and half chase.

The basic step consists of: Forward on left, recover weight on right, in place left, right, left; back on right, recover weight on left, right, left, right. The basic step entails a total of 10 steps.

The second variation consists of cross over breaks. The steps for the cross over step consist of: Cross with left, recover weight on right, in place left, right, left; cross with right, recover weight on left, in place right, left, right.

The third variation was the half chase. The steps for the half chase consists of: Step forward on left pivot around recover weight on right, in place left right left, step forward on right pivot around recover weight on left, in place right left right. There are a total of 10 steps for the half chase.

Procedures

The participants were given the opportunity to demonstrate the three dance patterns they learned. A music tape was played and the number of times a participant successfully reproduced the three dance patterns was scored. Participants had to demonstrate that they learned the three different patterns and were able to reproduce them in the order they were being called from the music tape.

All participants were tested individually in a quiet room. Instructions were read to the participants (Appendix B). Participants were randomly assigned to one of two groups taught by the researcher in two different settings. Six participants were assigned to the beat group and six participants were assigned to the music group. One half ($N=3$) was of each group and was tested in a random context and one half ($N=3$) was tested in a blocked context.

In the blocked group, participants were given two modeled demonstrations with verbal cueing of the basic step. The researcher walked the participants through their steps with verbal cueing a maximum of four times. Music was introduced with the

researcher cueing the participants on to the beat to practice. The duration of one song was given as practice time to practice each of the dance patterns. All participants got a total of 34.5 phrases as the length and duration of all their practice times for the three patterns whether they were in the blocked or random groups. Instructions and feedback were provided before the first trial practice time. Thereafter, the researcher encouraged the participants to continue on their own.

In the random group, all three dance patterns were taught together. Two demonstrations were given of the basic step, four walk through practices, two demonstrations of the cross over breaks, four walk through practices, and two demonstrations of the half chase with four walk through practices. Then, the participants were given 34.5 phrases maximum time as the length and duration for each of their three patterns. On the music tape, the names of the three dance patterns were called out randomly for the random group to practice.

The number of demonstrations and the walk through were held constant across blocked and random groups. Feedback was given to all participants during the learning stages only. Questions were answered during the four walk through practices. The selection of participants was restricted to people who had no previous experience with the cha cha dance. Participants were sought through the Psychology Department and also from Human Performance classes.

However, due to the inexperience of the researcher, some participants requested additional time to learn the patterns before the start of the practice tape and the researcher granted the participants with problems the additional time. Therefore, the variability of

the practice time among the participants was not well controlled as the overall study was stated and designed.

Design

Contextual interference is the circumstances surrounding an act or an event that might hinder performance. Battig described eight factors contributing to contextual interference. Two of these, multiple and variable processing, were studied in this experiment. The independent variable, multiple processing, was manipulated by providing music to one group consisting of a beat and other factors as well as a beat only group. Within these multiple processing contexts participants either performed the acquisition trials in a blocked or random order thus manipulating the contextual variety of the acquisition context.

The dependent variable was the number of steps correctly done within a phrase of music. The variable was measured by counting the steps performed correctly on beat while reproducing the three variations. The piece of music used contains 69 phrases. Two phrases were played to allow participants to find the beat before the actual collection of data began. Variation #1, variation #2, and variation #3 contained one phrase. One phrase contains 10 steps. There was a 5 minute retention interval provided before transfer began. During transfer, all participants were given a new piece of music to dance the three variations. A random order of dance patterns was provided for all participants in the transfer phrase. All participants were asked to reproduce the three dance patterns in the same order. Data were collected from the transfer phrase.

Analysis of Data

Data were measured in two ways. In the first measure, the measure was divided into phrases. Participants were awarded up to 10 points per phrase, measured by the number of coincident footsteps to the beat while reproducing the variation. There are 10 steps to each phrase, 34.5 phrases to the cycle of beat and music tape. Once the feet were off beat no further points were given for that phrase. Points were awarded for the next phrase. Each phrase was measured as 10 steps, 34.5 phrases to the cycle of beat and music tape. Of the 34 phrases, two phrases were allotted to students to find the beat before starting.

In the transfer measure, participants reproduced the three patterns with music with the patterns called out randomly.

A 2 (multiple processing) x 2 (variable processing) ANOVA with three levels was conducted on transfer dependent data. The independent variables contextual variety and multiple processing each had two levels. The dependent variable, number of correct steps was measured continuously. The repeated measure with 48 phrases was recorded on the data sheet (Appendix D).

Chapter 4

RESULTS AND DISCUSSION

The purpose of this chapter is to provide the results and discussion of the study. There were no significant differences found in the main effects for multiple processing nor contextual variety.

Statistical Results

A (multiple processing) x 2 (contextual variability) x (task) ANOVA with repeated measures on the last factor was conducted on the number of correct steps to analyze cha cha cha performance. The source table for the 3 way ANOVA is presented in Table 1. The analysis from this study found no statistically significant main effects or interactions. The performance measure, number of correct steps, which was specifically developed for the study failed to provide any variability in the transfer phrase. Most participants received a 10 for all phrases defined as perfect responses. The raw data can be found in Appendix D.

Table 1

Source table for the 2 (multiple processing) x 2 (variable processing) x 3 (task) analysis

Source	Sum of Squares	df	Mean Square	F
Context	.36	1	.36	.06
Type	.14	1	.14	.02
Context* Type	6.80	1	6.80	1.06
Task	.30	1	.30	.42
Task* Context	.28	1	.28	.39
Error (Task)	<u>5.74</u>	<u>8</u>	<u>.72</u>	

Discussion

The purpose of this study was to test the multiple processing and contextual variety components of Battig's contextual interference (1979) theory on the performance of the cha cha cha dance.

The ANOVA conducted to test the interaction effect of multiple processing and contextual variety failed to show any statistically significant effects. Therefore, the hypothesis that a multiple processing strategy and contextual variety would not interact to affect transfer of the cha cha cha was accepted. Further, neither of the main effects for multiple processing nor contextual variety were statistically significant. Therefore, the hypothesis that multiple processing would not affect transfer of the cha cha cha was accepted. Also the hypothesis that contextual variety would not affect transfer of the cha cha cha was accepted.

The following reasons are proposed here to explain why this study might have failed to support Battig's theory regarding multiple processing and contextual variety. First, the tasks were too easy. This study measured how well participants followed instructions, whether they learned the various patterns, and if they were able to distinguish between the three different patterns. For the volunteers who learned the three patterns, they seemed to be more confident when asked to reproduce the patterns during the retention and transfer phases of the study. Second, too much practice time was allotted for the given tasks. The extra practice time given improved the participants' skill levels and the measure developed did not distinguish among them. It was conceivable that the participants requested extra practice time because Magill and Hall (1990) found that learning motor skills under high contextual interference was difficult. Herbert, Landin, and Solmon (1996) found that high contextual interference at early stages of learning may be counterproductive. Third, the shoes worn by the participants contributed to poor results. Participants who showed up for the test wore combat boots, hiking shoes, and tennis shoes. These shoes are not made for dancing and may have even inhibited the dance movements. Some requested to dance in their socks because they were unable to turn with their shoes on. Performance with socks was a problem because it was too slippery for the beginners to maintain their balance. During the pilot study, shoes did not appear to be a problem because it was thought that it was the carpet inhibiting the turn. Fourth, a few participants wanted to practice the steps before the allotted time given because they did not want to continue being unsure of what the steps they were expected

to reproduce. This request should have been denied and was not. Instead, the participants were allowed extra practice time and consequently raised their skill level.

To get the participants to have enough skill to perform the measurements, the researcher overemphasized the teaching of the patterns to the participants during practice. As far as the garnering of the data, it was difficult to score the steps from the videotapes playback once an error was made using the equipment available to the researcher. It was difficult to rewind the tape back to the last error because the music was too fast. Playing the tape back in slow motion distorted the music and made it impossible to tell if participants were on beat with the music. The combination of all these factors made the data difficult to analyze in the fashion the researcher had intended.

Future Recommendations

There were a series of problems with this study and exemplified the difficulties in testing and measuring the contextual interference effect outside laboratory conditions or in the real world settings. There were numerous outside factors that influenced the outcome of the data that were not controlled or eliminated beforehand. Factors such as, proper dancing shoes, the time allowed to practice the given tasks, time given on individualized instructions, the distorted sound of the beats when playing back the video tape on slow motion. And as a result, the data were affected by these uncontrolled laboratory factors.

Future studies should be conducted addressing the outside factors from the problems with dependent measure controlled and the participants should not be given additional practice time. An important delimitation to conduct this study properly would

be to require dancing type of shoes. Comfortable dress shoes or shoes with a slippery sole should have been required for this study.

It is recommended that future studies use more sophisticated movement analyses to better delineate the results. For example, digitizing the movement and analyzing the tempo and correctness of the movement maybe conducted using a Peak System or other form of cinematographic analysis.

References

Barreiros, J.M.P. (1992). Variability of practice and contextual interference in children and adults. Motricidade-humana/Portuguese-journal-of-human-performance-studies-Lisboa, 8, 5-15.

Battig, W.F. (1966). Facilitation and interference. In: E.A. Biodeau (Ed.). *Acquisition of skill*. New York: Academic Press. p. 215-244.

Battig, W.F. (1972). 'Intrataask interference as a source of facilitation in transfer and retention'. In: R.F. Thompson and J.F. Voss (eds.), *Topics in learning and performance*. New York: Academic Press. p. 131-159.

Battig, W.F. (1979). The flexibility of human memory. In L.S. Cermak & F.I.M. Craik. (Eds.) Levels of processing in human memory. New York: Lawrence Erlbaum Associates Publishers.

Blandin, Y., Proteau, L & Alain, C. (1994). On the cognitive processes underlying contextual interference and observational learning. Journal of Motor Behavior, 26, 18-26.

Bortoli, L., Robazza, C., Durigon, V., & Carra, C. (1992). Effects of contextual interference on learning technical sports skills. Perceptual and Motor Skills, 75, 555-562.

Brady, F. (1997). Contextual interference and teaching golf skills. Perceptual and Motor Skills, 84, 347-350.

Carnhan, H., Van Eerd, D.L., & Allard, F. (1990). A note on the relationship between task requirements and the contextual interference effect. Journal of Motor Behavior, 22, 159-169.

Catela, D., & Barreiros, J. (1994). Contextual interference in a position task performed by children and young adults. Motricidade-humana/Portuguese-journal-of-human-performance-studies-Lisboa, 10, 30-42.

Del Rey, P., Wughalter, E.H., & Carnes, M. (1987). Level of expertise interpolated activity and contextual interference effects on memory and transfer. Perceptual and Motor Skills, 64, 276-284.

Gentile, A. M. (1972.) A working model of skill acquisition with application to teaching. Quest, Monograph XXII, 3-23.

Hall, K.G., Domingues, D.A., & Cavazos, R. (1994). Contextual interference effects with skilled baseball players. Perceptual and Motor Skills, 78, 835-841.

Hebert, E. P., Landin, D., & Solmon, M. A. (1996). Practice schedule effects on the performance and learning of low- and high-skilled studies: An applied study. Research Quarterly for Exercise and Sport, 67, 52-58.

Jarus, T., Wughalter, E.H., & Gianutsos, J.G. (1997). Effects of contextual interference and conditions of movement task on acquisition, retention, and transfer of motor skills by women. Perceptual and Motor Skills, 84, 179-193.

Jenkins, J.J. (1979). Four points to remember: A tetrahedral model of memory experiments. In L.S. Cermak & F.I.M. Craik (Eds.), Levels of processing in human memory. Hillsdale, N.J.: Erlbaum.

Lee, T.D., & Magill, R.A. (1983). The locus of contextual interference in motor-skill acquisition. Journal of Experimental Psychology: Learning, Memory and Cognition, 9, 730-746.

Lee, T.D., & Magill, R.A. (1985). Can forgetting facilitate skill acquisition? Differing perspectives in motor learning, memory, and control. Elsevier Science publishers B.V. (North-Holland).

Lee, T.D., & White, M.A. (1990). Influence of an unskilled model's practice schedule on observational motor learning. Human Movement Science, 9, 241-289.

Magill, R.A. (1983). Insights into memory and control in motor behavior through the study of context Effects: A discussion of Mathews et al. and Shea and Zimny. Memory and control of action. North-Holland publishing company.

Magill, R.A., & Hall, K.G. (1990). A review of the contextual interference effect in motor skill acquisition. Human Movement Science, 9, 241-289.

McKeachie, W.J. (1974). The decline and fall of the laws of learning. Educational Researcher, 1974, 3, 7-11.

Pollock, B.J., & Lee, T.D. (1997). Dissociated contextual interference effects in children and adults. Perceptual and Motor Skills, 84, 851-858.

Sekiya, H., Magill, R.A., & Anderson D.I. (1996). The contextual interference effect in parameter modifications of the same generalized motor program. Research Quarterly for Exercise and Sport, 67, 59-68.

Sekiya, H., Magill, R.A., Sidaway, B., & Anderson, D.I. (1994). The contextual interference effect for skill variations from the same and different generalized motor programs. Research Quarterly for Exercise and Sport, 65, 330-338.

Shea, J.B., & Morgan, R.L. (1979). Contextual interference effects on acquisition, retention and transfer of motor skill. Journal of Experimental Psychology: Human Learning and Memory, 5, 179-187.

Shea, J.B., & Zimny, S.T. (1983). Context effects in memory and learning movement information. Memory and control of action. Richard A. Magill (ed.). North-Holland publishing company.

Shea, J.B., & Zimmy, S.T. (1988). Knowledge incorporation in motor representation. In O.G. Meijeer & K. Roth (eds.), Complex motor behavior: the motor-action controversy. Amsterdam: Elsevier Science. p. 289-314.

Shewokis, P.A. (1997). Is the contextual interference effect generalizable to computer games? Perceptual and Motor Skills, 84, 3-15.

Smith, P.J.K. (1997). Attention and the contextual interference effect for a continuous task. Perceptual and Motor Skills, 84, 83-92.

Wrisberg, C.A. (1991). A field test of the effect of contextual variety during skill acquisition. Journal of Teaching in Physical Education, 11, 21-30.

APPENDIX A. Consent Form

Agreement to Participate in Research

Responsible Investigator(s): _____

Title of Protocol: _____

1. I have been asked to participate in a research study investigating Battig's Contextual Interference Theory in social dance.
2. I will be asked to reproduce three dance patterns of the Cha Cha Cha dance. The study will be conducted at San Jose State University in the Motor Learning Laboratory during the Spring semester of 1999.
3. There will be no foreseeable risks or discomforts to the subjects and no risks are anticipated for the duration of the study.
4. No discernible risks are expected.
5. A statement of the results of the study may be published but no information that could identify the subject will be included, or a specific "release to publish statement" will be provided.
6. The results of this study may be published but the identity of the subjects will not be disclosed.
7. Participants for this study are strictly done on a voluntary basis.
8. Questions about the research may be addressed to the principal investigator, Carol Wong, (408) 270-0298. Complaints about the research may be presented to the respective Chair, Emily H. Wughalter, (408) 924-3043. Questions about research, subjects' rights or research-related injury may be presented to (Nabil Ibrahim. Ph.D.). The Vice President for Graduate Studies and Research, at (408) 924-2480.
9. No service of any kind to which a subject is otherwise entitled will be lost or jeopardized if a person choose "not to participate" in the study.
10. Consent given to participate in this study are on a voluntary basis. A subject may refuse to participate in the study or in any part of the study. If a subject decides to participate in the study he or she is free to withdraw at any time without prejudice to the subject's relations with San Jose State University or any other participating institutions.
11. All subjects have received a signed and dated copy of the consent form.

***The signature of a subject on this document indicates agreement to participate in the study.**

***The signature of a researcher on this document indicates agreement to include the above named subject in the research and attestation that the subject has been fully informed of his or her rights.**

Signature

Date

Investigator's Signature

Date

Note: If consent form is more than one page each non-signature page must be initialized by subject.

APPENDIX B. Verbal Instructions

All participants will be given verbal instructions on all three dance patterns in addition to seeing the dance patterns modeled by the researcher. This study will be conducted in two meetings. Participants will be asked not to practice outside of the two meetings. The purpose of this study is to compare and measure the two groups to see whether contextual interference affect the learning of these dance patterns.

Participants in the Beat Only Group will be given: Two demonstrations of the forward and backward basic modeled by the researcher, four guided practice of the forward and backward basic steps with verbal cueing. Upon learning the dance patterns the Beat Sound will be introduced with the researcher cueing the participants to step on the sound of the beat. The format of two demonstrations, four guided practice with the researcher cueing the participants to step on the sound of the beat will be used for all three dance patterns. After 20 phrases of 10 trials the researcher will stop the tape and give participants feedback. The researcher will continue to stop the tape after every 20 phrases of 10 trials and give feedback for the duration of the song. The same format will be used for all three dance patterns for the Beat Group with the exception that the tape will stop after 10 phrases of five trials for the duration of the whole tape for dance patterns one, two, and three.

Participants in the Music Only Group will be given: Two demonstrations of the forward and backward basic modeled by the researcher, four guided practice of the forward and backward basic steps with verbal cueing. Upon learning the dance patterns Music will be introduced with the researcher cueing the participants to step on the sound

of the beats. The format of two demonstrations, four guided practice with the researcher cueing the participants to step on the sound of the beat will be used for all three dance patterns. After 20 phrases of 10 trials the researcher will stop the tape and give participants feedback. The researcher will continue to stop the tape after every 20 phrases of 10 trials and give feedback for the duration of the song. The same format will be used for all three dance patterns for the Music Group with the exception that the tape will stop after 10 phrases of five trials for the duration of the whole tape for dance patterns one, two, and three.

Participants will also be instructed and informed that if at anytime during the experiment they feel they cannot proceed with the experiment, to please notify the experimenter that they wish to discontinue with the experiment. If there are any other questions or concerns regarding this experiment, please contact Carol Wong at (408-0298).

APPENDIX C. Data Sheet

Transfer Scores

Basic Step	Cross Over Break	Half Chase
1.	1.	1.
2.	2.	2.
3.	3.	3.
4.	4.	4.
5.	5.	5.
6.	6.	6.
7.	7.	7.
8.	8.	8.
9.	9.	9.
10.	10.	10.
11.	11.	11.
12.	12.	12.
13.	13.	13.
14.	14.	14.
15.	15.	15.
16.	16.	16.

APPENDIX D. Raw Data

Participant Contextual Variant Multiple Processing																
Basic																
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
10	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
11	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
12	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Chase																
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
10	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
11	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
12	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Cross Over																
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
10	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
11	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
12	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0