

## TESTING ASSUMPTIONS OF DELIBERATE PRACTICE THEORY, RELEVANCE, EFFORT, AND INHERENT ENJOYMENT OF PRACTICE ON A NOVEL TASK<sup>1,2</sup>

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*Summary.*—This study examined three assumptions of the theory of deliberate practice: that deliberate practice is perceived as relevant for improving performance and that it requires effort, but that it is not perceived as being inherently enjoyable. Of particular interest was the assumption of inherent enjoyment of practice since that has been questioned in previous research. 30 undergraduate and graduate students combined practiced a maze memorization and recall task and rated relevance of practice for improving recall, the practice effort, and inherent enjoyment of practice. The findings were consistent with three assumptions, but also suggested that perceptions about relevance, effort, and inherent enjoyment of practice may change with increasing experience and performance.

The theory of deliberate practice attributes the achievement of expert performance to the prolonged effort to improve performance through the engagement in domain-specific practice (Ericsson, Krampe, & Tesch-Römer, 1993). One aspect of the theory suggests that deliberate practice is relevant for improving performance, that it demands physical or cognitive effort, but that it is not an inherently enjoyable activity. Studies involving music students (Ericsson, *et al.*, 1993; Lehmann, 2002), wrestlers (Hodges & Starkes, 1996), figure skaters (Starkes, Deakin, Allard, Hodges, & Hayes, 1996), martial artists (Hodge & Deakin, 1998), soccer and field hockey players (Helsen, Starkes, & Hodges, 1998), collegiate tennis, volleyball, and swimming coaches (Hyllegard, Radlo, & Early, 2001), and middle-distance runners (Young & Salmela, 2002) have considered these assumptions. In these studies, relevance, effort, enjoyment or pleasure in practice, and in some instances concentration during practice, were rated for different taxonomies of activity. These taxonomies included domain-specific deliberate practice activities (e.g., Practice Alone, Technical Skills, and Tactical Skills), physical fitness activities (e.g., Running, Cycling, and Weight Training), and everyday-life activities (e.g., Shopping, Cleaning, and Sleeping). The resulting ratings were examined statistically to ascertain which activities received mean scores either higher or lower than the grand mean for the relevant area. Activities receiving mean scores significantly higher than the grand mean were inter-

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puted as having high relevance, effort, enjoyment or pleasure of practice, or concentration during practice; activities receiving mean scores significantly lower than the grand mean were interpreted as being low in these same qualities.

While the findings for practice relevance and practice effort have mostly been consistent with deliberate practice theory, the findings for inherent enjoyment or pleasure in practice largely have not. In these studies, excluding Young and Salmela (2002) as the methods of analysis were different, 24 domain-specific activities involving deliberate practice, e.g., Practice Alone, Practice with Coach, Practice Drills, were rated (Appendix A, p. 294). Of these, 71% received significant high ratings for relevance of practice, 58% received high ratings for effort of practice, while only 4% received low ratings for inherent enjoyment or pleasure in practice. When these same ratings are examined by the criteria of being either greater than or less than the grand mean irrespective of statistical significance, 96% of the activities received high ratings for relevance, 83% high ratings for effort, while only 13% received low ratings for inherent enjoyment or pleasure ratings for practice (ratings for concentration largely parallel those for effort). More troubling for the assumption of inherent enjoyment in practice was that 46% of these activities actually received significantly high ratings, and 63% of these activities received high ratings irrespective of statistical significance. These findings are essentially just the opposite of the expected findings for inherent enjoyment or pleasure in practice stemming from the theory.

One study reported support for the assumption of an inverse relationship between effort and enjoyment in practice as suggested by the theory. Lehmann (2002) found moderate but significant correlation coefficients between practice effort and enjoyment for six deliberate practice activities ( $r = -.39$ ), eight nonpractice activities ( $r = -.36$ ), and for the 14 activities combined ( $r = -.34$ ). Among the six music-related activities rated, one received a low rating for enjoyment (Problem Spot Practice), another received a high rating (Study New Repertoire), and the four others received neutral ratings (Memorizing, Playing Familiar Repertoire, Practicing Performance, and Technical Practice). The study, involving 26 mostly first-year students attending an exclusive music academy, suggested that, while music students perceive deliberate practice activities as both relevant for improving performance and requiring effort, some of these activities were perceived as not being particularly enjoyable. Lehmann suggested that, while deliberate practice may not be inherently enjoyable in principle, it might be important to distinguish among specific activities because perceptions formed about different activities could be independent of one another.

Certain commonalities among the previous studies may help to explain the findings for practice inherent enjoyment or pleasure, which were largely

just the opposite of those suggested by the theory. One of these is a subtle distinction between the concept of inherent enjoyment in practice, as defined in the deliberate practice theory, and finding certain aspects of practice enjoyable. The inherent enjoyment assumption is based on the difference between deliberate practice and other types of activity such as play, work, or public performance. The theory suggests that the motivation to engage in deliberate practice is fundamentally different than the motivation to engage in these other forms of activity, and these differences inform perceptions of these activities. The motivation for engaging in playful behavior is primarily enjoyment while the motivation for engaging in work and public performance is primarily to earn some form of reward. Since the primary motivation for engaging in deliberate practice is to improve later performance, and it demands effort but is not associated with immediate rewards, the theory suggests that it is not inherently enjoyable (Ericsson, *et al.*, 1993). The theory accepts the possibility of experiencing enjoyment while practicing; sources of practice enjoyment include social interactions among team members, the interactions between the athlete and the coach, and meeting new performance goals, among others (Ericsson, 1996). However, these aspects of practice are different from actively engaging in deliberate practice activity during a practice session. This distinction between inherent enjoyment of practice and finding certain aspects of practice enjoyable may not have been entirely clear to the participants in the previous studies.

A second issue the previous studies had in common was that the participants did not actually engage in deliberate practice prior to giving the ratings for relevance, effort, and enjoyment or pleasure of practice. Presumably it was assumed that the participants were familiar enough with the activities being rated so that it was not necessary to engage in deliberate practice prior to giving the ratings. However, if deliberate practice requires effort and is not inherently enjoyable, then it may be more pertinent to make such ratings immediately following a practice session.

Another issue was the way in which the activity ratings were statistically analyzed in the respective studies. Following the lead of Ericsson, *et al.* (1993), a *post hoc* analysis with a Bonferroni correction was used to identify activities lower or higher than the grand mean for the activity. The process involved comparing the domain-specific deliberate practice activities with ratings for every other activity. Consequently, the ratings for domain-specific deliberate practice activities, such as Practice Alone, for example, were compared with unrelated activities such as Cleaning House. This approach made it difficult to evaluate the ratings just for the deliberate practice activities within the particular domain of expertise. Two studies (Starkes, *et al.*, 1996; Young & Salmela, 2002) addressed this issue by analyzing the domain-specific ratings separately from everyday ratings. In both studies however, the

most relevant activities for improving performance still received high ratings of enjoyment.

Another common feature of previous studies was that the participants were in the Investment Years (Côté, 1999) of their careers (except Hodges & Starkes, 1996). Investment years are defined as the period in a career when people are most committed to and engaged in a particular activity. It may be somewhat incongruous for such people to report that practice is not inherently enjoyable given their current commitment to an activity. In addition, it has also been reported that such people do not necessarily devote a lot of time to true deliberate practice during a given practice session. Deakin, Starkes, and Allard (1998), for example, found that expert ice skaters actually spent more time rehearsing familiar skills than deliberately practicing skills for which they were less accomplished. So while the participants may have thought they were rating true deliberate practice activities, they may have been only rating well-entrenched activities that do not still require a lot of deliberate practice.

Since all of the previous studies reported similar outcomes based on similar methods, the purpose of the present study was to examine the three assumptions in a way that was different from what had been done in other related studies. The present study involved a novel laboratory task which was deliberately practiced over the course of three days. Immediately following each practice session, the participants rated the relevance of practice in improving performance on the task, and the effort, and inherent enjoyment of practice. The working hypotheses, based on the theory of deliberate practice, was that the mean ratings for relevance and effort of practice made following each practice session would both be greater than the mean ratings for inherent enjoyment of practice. The ratings of relevance and effort of practice were not expected to differ from one another.

## METHOD

### *Procedure*

*Participants.*—Thirty volunteer participants (college undergraduate and graduate students) engaged in the deliberate practice of maze memorization and reproduction of the task. All participants received course credit for partaking in the study; to receive the credit, participants were expected to make a good-faith effort throughout the study. They were also informed that they were free to terminate involvement in the study at anytime with no penalty. All of the original 30 participants fully completed the study, and all earned the course credit.

*Maze task.*—The task involved memorizing and reproducing a maze of 36 line segments. Of these, 23 consecutive segments formed a path through the maze from the starting point to the ending point (Sackett, 1934, 1935).

The maze was presented visually for a 1.5-sec. memorization interval; this interval was immediately followed by a 30-sec. reproduction interval when the participants drew as much of the 23-segment route as they could by hand on graph paper (the other 13 line-segments which were not part of the path were not drawn). Practice consisted of three blocks of 20 practice trials, divided among three consecutive days, for a total of 60 trials. A single-trial retention test was also given two days following the final block of practice. Each of the 61 drawings were made on a clean piece of graph paper, and the participants were not allowed to see or review any of the previous practice trial drawings once a given trial was completed. Just prior to the beginning of the second and third practice blocks, and the retention test, verbal knowledge of results (KR) information was given. The knowledge of results consisted of the number of correctly drawn line segments for each of the 20 previous trials (60 KR instances in all for the complete study). For example, a participant may have been told that on Trial 15, the total of the first 11 consecutive segments were correctly reproduced. Calculating the number of correctly drawn line segments for each trial always started with segment 1 of the path through the maze consecutively through to the segment where the first error occurred; scores on each trial ranged from 0 to 23 correct segments. These procedures met the four requirements for deliberate practice (Ericsson, 1996): a well-defined task with appropriate difficulty, informative feedback, opportunities for repetitions, and error corrections (pp. 20-21).

An Apple iMac computer running the MindLab application was programmed to administer the practice trials automatically. Before starting the practice trials, an example trial (with a different maze pattern) was shown to familiarize participants with the sequence of images and time intervals used during each phase of the practice trials.

*Ratings of practice.*—At the completion of each of the three blocks of practice, the participants rated the relevance, effort, and inherent enjoyment of practice on a scale anchored by 0: low and 10: high. As part of the instructions, the operational definitions of the terms relevance, effort, and inherent enjoyment of practice were given to the participants as a prepared script. Relevance of practice was defined as the extent to which the practice trials improved performance on the maze task. Effort of practice was defined as the cognitive effort needed to improve performance on the task. Inherent enjoyment of practice was defined as the extent to which the practice trials were enjoyable irrespective of the practice outcomes, such as improved performance on the task. The example for inherent enjoyment of practice was adopted from Ericsson, *et al.* (1993): “When rating the inherent enjoyment of cleaning one’s house, it should reflect the enjoyment of the actual activity, and it should disregard the enjoyment of the results (i.e., a clean and attractive house)” (p. 373).

*Ratings of daily activity.*—The participants also rated effects of six other activities for improving school grades from among studying for finals, writing papers, attending class, practicing sports, playing sports, and watching movies. These ratings were made for two reasons, first, to help define the concepts of the relevance, effort, and inherent enjoyment of practice by providing examples of activities familiar to college students. Second, these ratings were used to assess the consistency of the maze practice ratings by comparing them to some common activities associated with college. These ratings were made by the participants immediately following the instructions and just prior to starting of the first block of practice trials.

## RESULTS

### *Maze Task*

The mean numbers of correctly drawn line segments reproduced during each session were as follows for Block 1 ( $M=7.32$ ,  $SEM=0.94$ ); Block 2 ( $M=13.08$ ,  $SEM=1.30$ ); Block 3 ( $M=17.17$ ,  $SEM=1.13$ ), and for the retention test ( $M=18.57$ ,  $SEM=1.33$ ). A repeated-measures analysis of variance was used to examine the number of correct line-segment scores for each practice block and the retention test ( $F_{3,87}=63.41$ ,  $p<.01$ ; Greenhouse-Geisser  $\lambda=.86$ ). A Scheffé *post hoc* analysis indicated that the mean number of correctly drawn line-segments on each of the three practice blocks was different from one another, and that the mean for the retention test differed from the Block 1 and Block 2 means but not from the Block 3 mean. These analyses showed that performance on the maze task improved with practice, and the retention test showed that the participants retained the capacity to reproduce the maze at a level not significantly different than the final block of practice two days following the end of practice.

### *Practice Ratings*

A two-way mixed analysis of variance was used to examine the type of rating (relevance, effort, inherent enjoyment) by the practice blocks (Block 1, Block 2, Block 3) for the practice ratings (with repeated measures for practice blocks). Analysis indicated a ratings by block interaction ( $F_{4,174}=4.82$ ,  $p=.001$ ; Greenhouse-Geisser  $\lambda$  for blocks=.73). Analysis of the interaction's simple effects involved examining the cell means for the practice relevance and practice effort scores across Block 1 and Block 2 and then across Block 2 and Block 3, and between the scores for effort of practice and inherent enjoyment of practice across the three blocks of practice to identify the source of the interaction as identified in the initial two-way analysis of variance (Keppel, Saufley, & Tokunaga, 1992; Vincent, 1999). The analysis of the interaction means for ratings of relevance and effort of practice across practice Block 1 and Block 2 was significant ( $F_{1,58}=7.67$ ,  $p=.008$ ;

Greenhouse-Geisser  $\lambda$  for blocks=1.00), while the analysis across Block 2 and Block 3 was not ( $F_{1,58}=3.71$ ,  $p=.06$ ; Greenhouse-Geisser  $\lambda$  for blocks=1.00). There was also a significant interaction between the effort of practice and the means for inherent enjoyment of practice across practice Blocks 1 through 3 ( $F_{2,116}=4.75$ ,  $p=.01$ ; Greenhouse-Geisser  $\lambda$  for blocks=.74). The outcomes for mean rated effort and inherent enjoyment of practice from Block 1 to Block 2 ( $p=.07$ ) and from Block 2 to Block 3 ( $p=.08$ ) were not significant.

Fig. 1 shows the mean ( $\pm$  SEM) for ratings of relevance, effort, and inherent enjoyment of practice for practice Blocks 1 through 3. While the mean scores for the ratings of relevance and inherent enjoyment of practice remained largely consistent across the practice blocks, the ratings for effort in practice decreased as the amount of practice increased. The figure also shows practice relevance and practice effort were both comparatively high, and the ratings of inherent enjoyment of practice were comparatively low, as predicted by the theory.

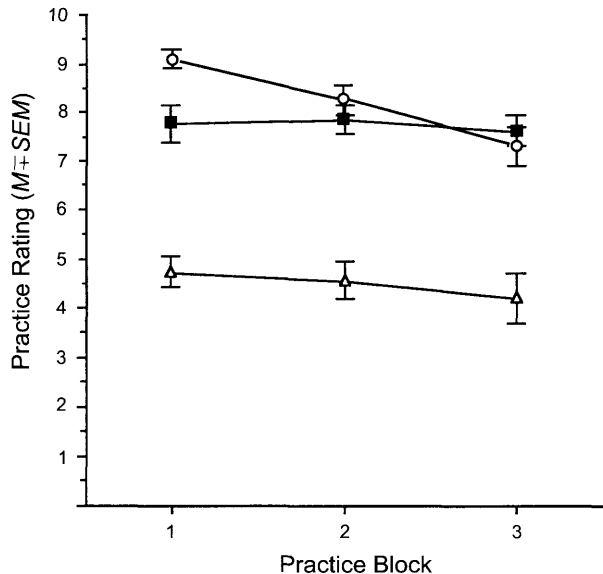


FIG. 1. Mean ( $\pm$  SEM) for ratings relevance (■), effort (○), and inherent enjoyment (△) of practice for practice Blocks 1–3 for the maze memorization and reproduction tasks

### *Ratings of Daily Activities*

Table 1 shows the mean ratings for the daily activities as well as the mean maze ratings for the three blocks of practice. The ratings for the daily

activities and maze practice are consistent with the three assumptions of deliberate practice theory for relevance, effort, and inherent enjoyment of practice. For example, studying for finals received comparatively high ratings of relevance and effort of practice and low ratings for inherent enjoyment of practice. Likewise, watching movies received low ratings for relevance of effort of practice and high ratings of enjoyment of practice. Ratings of maze practice are consistent with the ratings of daily activities since the means for relevance and effort of practice were comparatively high, while the rating of inherent enjoyment in practice was comparatively low. Analyses by Pearson correlation for the activity ratings show significant associations between pairs of ratings: relevance with effort of practice,  $r = .89$  ( $p < .05$ ); relevance with inherent enjoyment of practice,  $r = -.91$  ( $p < .05$ ); and effort with inherent enjoyment of practice,  $r = -.74$  ( $p < .05$ ).

TABLE 1  
MEAN RATINGS OF RELEVANCE, EFFORT, AND INHERENT ENJOYMENT OF PRACTICE (0: LOW, 10: HIGH)  
FOR DAILY SCHOOL ACTIVITIES ON IMPROVING GRADES AND FOR MAZE PRACTICE (COLLAPSED  
ACROSS BLOCKS 1-3) FOR IMPROVING TASK PERFORMANCE

School Activity	Relevance <sup>a</sup>	Effort <sup>b</sup>	Inherent Enjoyment <sup>c</sup>
Studying for Finals	9.13	9.07	3.47
Writing Papers	8.07	8.57	3.77
Attending Class	8.07	7.17	5.90
Practicing Sports	4.67	6.50	8.43
Playing Sports	4.80	6.67	9.40
Watching Movies	3.10	2.67	8.37
Maze Practice	7.78	8.26	4.33

Note.— $r^{ab} = .89$ ;  $r^{ac} = .91$ ;  $r^{bc} = .74$ .

### DISCUSSION

The theory of deliberate practice suggests that such practice is perceived as relevant to improving performance and requiring effort, but that it is not perceived as an inherently enjoyable activity (Ericsson, *et al.*, 1993). The findings from the maze task in the present study are consistent with these assumptions. While other investigations have supported the assumptions of relevance and effort of practice, most other investigations have reported either neutral inherent enjoyment of practice or pleasure finding or findings that were just the opposite of those predicted by the theory (e.g., Helsen, *et al.*, 1998; Hodge & Deakin, 1998; Young & Salmela, 2002).

The present findings also suggest that these perceptions evolve as the level of expertise changes. Although the rating of relevance and inherent enjoyment of practice were consistent across the practice blocks, the ratings of effort in practice decreased as the amount of practice and performance increased. While the theory of deliberate practice makes no specific assumptions about how perceptions of these qualities may change with experience,



the present findings suggest that these perceptions may be elastic based on the amount of experience. One caveat, however, concerns the nature of the maze memorization task used in the present study when compared with activities such as sports or music. While difficulty tends to increase as skills increase in sports or music, the difficulty of the maze task remained constant across all practice trials. The decreasing ratings of effort in the present study may reflect an increasing performance on a task of constant difficulty.

Ericsson, *et al.* (1993) suggested that individuals engage in deliberate practice primarily because it is perceived as an instrumental means for improving performance and discussed some of the reasons why deliberate practice is not an inherently enjoyable activity (Ericsson, 2001). Deliberate practice requires full concentration and high effort before the practice can produce meaningful gains in performance. Since this type of practice is necessary for learning complex new skills, learners may be hesitant to engage in such practice without some effective motivation. Since practicing difficult or unfamiliar skills increases the likelihood of making mistakes and performing poorly, error-prone practice is presumably less enjoyable than other activities that are more familiar and are performed more reliably. Related to this is the confidence the learner has that outcome of the practice will be successful. Practicing unfamiliar skills is naturally associated with outcomes that are not always successful, and that may lead to low confidence.

Other studies have supported relevance and effort of practice in deliberate practice theory, while questioning aspects of the assumption of inherent enjoyment of practice; particularly for expert athletes (e.g., Hodges & Starkes, 1996; Starkes, *et al.*, 1996; Hensen, *et al.*, 1998; Young & Salmela, 2002). While athletes have indicated that the most relevant practice activities are also enjoyable, when patterns of actual practice have been examined, consistent negative correlations between ratings of practice activity and relevance of that practice have been found. For example, Deakin, *et al.* (1998) reported that wrestlers rated full sparring as the most relevant practice activity as well as the most enjoyable one, yet they found that less than 10% of total practice time is devoted to sparring. In the same study, ice skaters overestimated the actual amount of deliberate practice engaged in for difficult skills during a typical practice session. The skaters actually devoted the majority of a practice session to performing skills that were already well learned.

Several aspects of practicing sports have been identified as sources of practice enjoyment. For example, Watanabe (2000) found that providing knowledge of results, such as split times for swimmers, is a source of enjoyment for athletes. However, Ericsson (1996) noted that it is easy to confuse the results of an activity (improved performance) with its inherently enjoyable nature. Another common source of enjoyment is the intrinsically social

nature of sports, which contributes to the enjoyable aspects of practice (Ericsson, 1996). While the social aspects of practice may be very enjoyable, the theory suggests that the actual practice is not inherently enjoyable. This may hold for both team and for individual sports in which the athletes are members of a team such as collegiate track, tennis, or swimming.

It has been suggested that the sports commitment model (Scanlan, Carpenter, Schmidt, Simons, & Keeler, 1993) may describe the relationship between relevance, effort, and enjoyment of practice more suitably than does the theory of deliberate practice (e.g., Starkes, *et al.*, 1996; Young & Salmela, 2002). The model identified factors that contribute to highly committed participation in sports and found that sport enjoyment, alternatives for involvement, personal investments, social constraints, and opportunities for involvement are important aspects. However, finding enjoyment while participating in sports is not the same as finding deliberate practice inherently enjoyable. While aspects of sports practice may be enjoyable, those perceptions should be considered relative to other forms of sports participation, such as playful engagement or competitions. For example, Hyllegard, *et al.* (2001) reported that Real Competitions were rated as the most enjoyable aspect of sports participation when compared to Practice Alone, Practice with Team, or Practice Competitions.

To the extent that the practice on this maze task can be generalized to other activities, the findings from the present study support the assumptions of relevance, effort, and inherent enjoyment of practice predicted by the theory. Two issues may affect how well present findings generalize to the studies. First, previous research concerning the theory of deliberate practice has involved experts in music and in sports domains. The task in the present study was in the cognitive domain and involved memorization and recall skills. Second, the study only involved 60 practice trials taking place over three days. The theory of deliberate practice suggests that expertise develops over an extended period of time, at least 10 years in most cases. However, the theory does not necessarily limit the predicted perceptions formed about the relevance, effort, and inherent enjoyment of practice only to experts or to any one type of activity (Ericsson, 1996). In other words, inferences stemming from the theory should apply to any amount of expertise and to practice in any domain. Just as performance changes with practice, the findings from the present study also suggest that the relationships among learners' perceptions about the relevance, effort, and inherent enjoyment of practice associated with deliberate practice also may change depending on the skill being learned. These findings are also consistent with Lehmann's suggestion (2002) that perceptions formed about the relations among relevance, effort, and inherent enjoyment of practice may depend on the specific activity practiced.

While the theory of deliberate practice does not address how these perceptions may change over time, the basic prediction that deliberate practice is perceived as relevant and effortful, but not inherently enjoyable appears viable. The present findings also suggest that further research into the changes in these perceptions with varied expertise may be warranted.

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## APPENDIX A

The deliberate practice activities rated in previous studies:

Deakin, J. M., Starkes, J. L., & Allard, F. (1998)

Lessons with Coach and On-ice training.

Ericsson, K. A., Krampe, R. T., & Tesch-Römer, C. (1993)

Practice Alone, Practice with Others, and Taking Lessons.

Helsen, W. F., Starkes, J. L., & Hodges, N. J. (1998)

Soccer individual practice: Coach Alone. Team practice: Technical Skills and Games and Practice. Field hockey individual practice: Coach Alone and Technical Skills. Team practice: Tactical Skills and Technical Skills.

Hodge, T., & Deakin, J. M. (1998)

Practice with others: Sparring, Group Classes, Impact Training, and Kata Training. Practice alone: Alone with Instructor, Kata Training, and Bag Training.

Hodges, N. J., & Starkes, J. L. (1996)

Practice with others: Mat Work. Practice alone. Work with Coach.

Hyllegard, R., Radlo, S. J., & Early, D. (2001)

Practice Alone, Practice with Team, Practice Competitions.