Motor Performance as a Function of Audience Affability and Metaknowledge

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Butler and Baumeister (1998) suggested that performance decrement of a difficult skill-based task occurring only in the presence of a supportive audience could be explained by “a cautious performance style” (p. 1226). A potential alternative explanation stems from Masters’ (1992) contention that skill failure under pressure occurs when performers attempt to control motor performance using explicit knowledge. It was proposed that a skill acquired with minimal metaknowledge (i.e., a limited explicit knowledge base) would remain robust regardless of audience type. To test this hypothesis, a table tennis shot was learned with either a greater or a lesser bank of explicit task knowledge. Performance was subsequently assessed in the presence of observation-only audiences, supportive audiences, and adversarial audiences. Consistent with hypotheses, supportive audiences induced performance decrement in the explicit-learning group only. It was argued that supportive audiences engender higher levels of internally focused attention than do adversarial or observation-only audiences, increasing the chance of disruption to skill execution when performance characteristics involve a large amount of explicit processing.

Key Words: skilled performance, explicit learning, implicit motor learning

The performance effects associated with the presence of coactors and audiences have been examined by scientists for over 100 years (e.g., Triplett, 1898). Generally it has been shown that the performance of well-learned skills improves in the presence of others while the performance of novel skills deteriorates. Most social facilitation theories attribute audience effects to increases in arousal, which may be fostered by competition, social comparison, high performance expectancies, evaluative judgments, encouragement, and the mere presence of others (Baron, 1986, cited in Butler & Baumeister, 1998; Cottrell, 1972; Latané, 1981; Tesser, Campbell, & McIntosh, 1989; Zajonc, 1965).
An area of applied sport research that has been concerned with the effects of audiences on sport performance is the homefield advantage. Results have consistently demonstrated that among major professional and college leagues, there is a performance advantage associated with competing at home (Courneya & Carron, 1992). While factors such as the crowd, travel, and familiarity with the venue have been shown to contribute to the home advantage (Courneya & Carron), the positive impact of the audience on home team performance has received the most support (Nevill & Holder, 1999). On the basis of these findings, one might expect supportive spectators to facilitate the performance of well-learned motor skills.

Baumeister and Steinhilber (1984) contended, however, that during critical and decisive games, supportive audiences may actually be detrimental to performance. Their hypothesis was supported by analysis of Major League Baseball results from 1924 to 1982 which showed that home teams won only 39% of their decisive championship games, compared with an average home winning percentage of 60% earlier in the season. This reduction of the home advantage during decisive championship games, termed the “championship choke” (Baumeister, 1985), has also been reported for archival studies of golf and ice hockey (Wright, Jackson, Christie, McGuire, & Wright, 1991; Wright, Voyer, Wright, & Roney, 1995; but see Schlenker, Phillips, Boniecki, & Schlenker, 1995). Furthermore, controlled laboratory studies (Baumeister, Hutton, & Cairns, 1990; Butler & Baumeister, 1998; Heaton & Sigall, 1991) indicate that supportive audiences can have a negative impact on performance, even when a championship is not at stake, for reasons associated with self-presentation.

Self-presentation refers to the process of claiming a desired identity through public performances (Schlenker & Leary, 1982). As the importance of the desired identity increases, concerns about self-presentation increase correspondingly. Numerous theorists have speculated that performers’ concerns about making a favorable impression on an audience may interfere with their successful execution of skilled tasks by increasing their self-focused attention (Baumeister, 1982; Hull & Levy, 1979; Schlenker & Leary, 1982).

In a recent series of laboratory experiments, Butler and Baumeister (1998) examined the influence of different audience types (i.e., neutral, supportive, adversarial) on performance of a skilled motor task. In two experiments the participants played a video game in which they had to steer an airplane through an obstacle course as quickly as possible. After the task was learned, participants’ performance levels were consistently high under all audience conditions when the criterion for success was easy. When the criterion for success was difficult, however, there was a significant decline in performance in the supportive-audience condition only. Butler and Baumeister asserted that, for self-presentational reasons, participants adopted a cautious performance style in the presence of supportive others, which led to suboptimal performance.

In one of their studies, Butler and Baumeister provided further evidence for a self-presentational explanation of the performance decrements under supportive audience conditions in the form of increased levels of self-attention. That is, participants in the supportive audience condition reported higher self-attention, yet the mediational role of self-attention in the audience condition/performance relationship was not supported by their analyses.

Although heightened self-awareness leading to a more cautious performance style is a plausible explanation for the disruption of task performance observed in
the Butler and Baumeister work, their data fall short of providing evidence of a cognitive-behavioral mechanism through which heightened self-attention brought on by a supportive audience impacted performance. However, theory and research on motor skill performance under stress offers a complementary perspective that is consistent with their explanation.

Heightened self-attention has been theorized to result in the performer trying to consciously monitor and control the execution of the skill to ensure that it is performed correctly (Baumeister, 1984; Masters, Polman, & Hammond, 1993). Masters et al. (1993) described this process as “reinvestment,” which they defined as “the tendency to introduce conscious control of a movement by isolating and focusing on specific components of it” (p. 664). Research has shown that, paradoxically, such conscious interference can lead to suboptimal performance by undermining the automatic nature of skill execution (Baumeister, 1984; Kimble & Perlmuter, 1970; Masters et al., 1993). Thus, heightened self-attention brought on by a supportive audience could have led to increased conscious control over participants’ actions, which in turn caused a performance decrement in Butler and Baumeister’s studies.

The objective of the present study was to extend the research of Butler and Baumeister to examine the effect of supportive and adversarial audiences on skilled motor performance. Within this overall objective were two purposes. The main purpose was to examine the effect of audience affability on performance of a complex motor skill that was acquired with either a greater or a lesser degree of explicit knowledge, thus allowing further examination and clarification of the self-attention mechanism proposed by Butler and Baumeister.

Two types of knowledge can be acquired during motor skill learning: explicit and implicit. The first type, explicit or declarative knowledge, refers to describable explicit rules about how the task can be accomplished. Generally one can acquire explicit knowledge by either testing the hypotheses about the appropriate rules for accomplishing the task while learning on his/her own, or by receiving explicit information from a teacher or coach as to the appropriate actions for accomplishing the task. In both cases performers can acquire extensive meta-knowledge or rules about task performance. The second type of knowledge associated with motor skill acquisition, implicit knowledge, refers to task knowledge that is difficult to express or explain. Implicit learning is an incremental and continual byproduct of ongoing processing. The resultant knowledge is acquired in the absence of any awareness that it has been acquired, and it can be applied unconsciously (Berry & Dienes, 1993; Cleermans, Destrebecqz, & Boyer, 1998; Jimenez & Mendez, 1999; Reber 1967, 1989). Rather than conceptualizing the explicit/implicit learning distinction as polar, we will consider explicit/implicit knowledge acquisition as concurrent, with motor skills lying on a continuum ranging from greater to lesser involvement of explicit processing during skill execution.

Butler and Baumeister (1998) hypothesized that performance degradation under supportive audience conditions was due to increased self-focused attention. If this is correct, we would only expect to see the negative effect of a supportive audience when participants have knowledge about the task on which to focus their attention (i.e., when they have explicit knowledge). In contrast, when participants have learned implicitly, they should have little available task knowledge on which to attend, and consequently their performance should be less affected. To examine this issue in the present study, we encouraged one group of participants to acquire
explicit rules during learning whereas a second group employed analogy learning in an attempt to reduce the acquisition of explicit knowledge.

Consistent with the procedures developed by Butler and Baumeister, three audience types were used: supportive, adversarial, and observation-only. In order to facilitate the acquisition of verbalizable knowledge, participants exposed to the explicit learning protocol were given a list of written instructions to follow as they practiced a table tennis forehand shot. For the analogy learning protocol, we employed a procedure developed by Masters and colleagues (Liao & Masters, 2001; Masters, 2000) that was designed to retard the accumulation of explicit knowledge. The analogy protocol provides a “biomechanical metaphor” which encourages production of an efficient movement without providing explicit knowledge of its underlying mechanics. Liao and Masters showed that this form of learning results in performance that characterizes implicit learning (e.g., low verbalizable task knowledge, robustness to stress). It was hypothesized that the analogy-learning group would exhibit robust performance under all audience conditions whereas the explicit-learning group’s performance was expected to deteriorate in the presence of a supportive audience.

A series of manipulation checks were imbedded in the study design to verify that the analogy-learning group displayed characteristics of implicit learning. Because implicit learning should be associated with the acquisition of few verbalizable rules (Reber, 1967), verbal protocols about task execution were used in order to indicate the amount of verbalizable knowledge or metaknowledge accumulated during learning. This test has been a common feature of the literature on implicit motor learning (Hardy, Mullen, & Jones, 1996; MacMahon & Masters, 2002; Masters, 1992; Maxwell, Masters & Eves, 2000). In addition, further evidence of demarcation between explicit and analogy conditions was gained by testing performance under a secondary task load after the learning phase. Implicit processes are, by definition, not demanding of attention and should allow one to perform a concurrent secondary task without suffering a performance decrement to the primary motor task (Berry & Broadbent, 1988; Maxwell et al., 2000; Maxwell, Masters, Kerr, & Weedon, 2001). Performance for the analogy group, but not the explicitly instructed group, was expected to remain robust under the secondary task load.

Manipulation checks were also carried out to assess the extent to which participants viewed each audience condition as stressful, hostile, or supportive. Other measures were also administered to test for distraction as a competing mechanism to self-focused attention, and to assess the level of effort perceived during the audience phase. These measured the extent to which each audience condition was perceived as distracting, and how much effort the participants had expended in each audience condition. A final measure of perceived performance assessed how well participants felt they had performed.

Similar to the obscuration of actual performance by Butler and Baumeister, objective shot outcome was withheld when participants performed in the presence of an audience using liquid crystal glasses that occluded vision from when the bat struck the ball until just before the next ball was presented. This procedure was intended to prevent the performer from receiving objective feedback about his or her level of performance without incurring a performance cost.

Given the ambiguity surrounding the results of Butler and Baumeister, further clarification of the mechanisms underlying disruption of performance in supportive-audience conditions has potential implications for sport research and
practice. However, since the task used by Butler and Baumeister was a video game, the external validity of their results as they pertain to the disruption of sport skill performance is also open to question. For example, the cognitive and visuospatial processes involved in manipulating a video game differ markedly from the processes required to kick a soccer ball into a goal or hit a topspin forehand drive in table tennis. Consequently, the second purpose of the study was to extend the research of Butler and Baumeister to determine whether the effects associated with supportive audiences are reproducible in the sports domain.

**Method**

**Participants**

Twenty-eight (14 M, 14 F) undergraduate students (mean age 20.36 yrs, \( SD = 0.95 \)) volunteered to participate in the study. The pool of participants was stratified by gender and randomly assigned to either an Analogy Learning or an Explicit Learning group, and each group comprised 7 men and 7 women. Participants were right-handed table tennis novices; they had never received any form of instruction nor had they played or practiced more than once in 2 weeks.

**Apparatus**

Table tennis balls (Donic Double-Happiness Trainer) were delivered from one end of a standard table-tennis table by a robot (Newgy Robo-Pong 2000). The robot rotated continuously through a 30° angle, directing balls to land on the receivers’ side of the table at various positions at a frequency of 25 per minute. Balls arrived with backspin and reached maximum height at the edge of the table.

During the audience performance phase of the experiment, visual feedback to participants was controlled via liquid crystal glasses (Plato Systems, Translucent Technologies, Toronto) attached to a specially adapted Donic Series 500 table tennis bat. A piezoelectric bi-morph vibration element (Radio Spares, Corby, UK) was mounted under the rubber and glued directly to the wood of a standard bat (Donic Series 500). The piezo sensor sent a signal to an amplifier and filter (band-pass 850 to 1200 Hz) from where the signal was rectified and smoothed again and used to trigger a standard 555 timer wired as a monostable circuit. The output from this signal closed a reed relay used to activate the glasses, rendering them opaque for 300 ms and thus preventing visual feedback of where the ball landed for each shot.

**Measures**

**Task Performance.** The primary dependent variable in the study was an accuracy score determined by points awarded for table-tennis topspin forehand drives. Specifically, participants were required to hit a topspin forehand so that the ball landed in a target area on the top left corner of the opposite end of the table.

A score between 1 and 5 was given for each technically correct topspin forehand shot clearing the net and landing in the target area shown in Figure 1. One point was awarded for simply clearing the net and landing the ball on the opposite side of the table. The main target zone comprised an isosceles triangle with 80-cm equal sides. This was partitioned into the three lower scoring zones, comprising 15-cm bands starting from the hypotenuse, becoming progressively smaller to the
5-point zone which comprised an isosceles triangle with 35-cm equal sides. A score of 0 was given for any shot that cleared the opposite side of the table or hit the net. Technically incorrect shots, those without topspin, were also awarded 0 points. An experimenter scored the performance via a video link-up.

Verbal Protocols. At the conclusion of the learning phase, participants were instructed to write down any rules or knowledge they had used or had become aware of during the previous trials. These protocols were later scored blindly by independent raters to assess the number of explicit rules related to technical and mechanical aspects of the shot.

Manipulation Checks. Immediately following each block of audience trials, the participants responded to a series of five questions. Three served as manipulation checks of their perceptions of each audience as “stressful,” “hostile,” or “supportive” (1 = not at all, 10 = very much). One assessed the “level of effort” (1 = minimum, 10 = maximum) the participants expended during the audience conditions, and another measured the extent to which they believed each audience had been “distracting” (1 = not at all, 10 = very much). A final question provided a measure of perceived performance. Participants were asked to rate “How good do you think your performance was?” (1 = very poor, 10 = excellent).

Design

The experiment consisted of a learning phase (including transfer phase) and an audience phase. In the learning phase, participants hit eight blocks of 50 trials followed by transfer and baseline blocks of 50 trials. During transfer, they were required to perform a secondary task concurrently with the hitting task. The baseline block of trials provided data on which to base the criterion for success in the audience phase\(^1\). All blocks were separated by 2-minute rest intervals.

\(^1\)In Butler and Baumeister’s study, the paradoxical performance effect was only apparent when the criterion for success was difficult. To accommodate this, a target score was set at 10% above baseline for each participant.
The audience phase took place after a 24-hr interval and consisted of a warm-up (50 trials) followed by three separate blocks of 50 trials in the presence of each of observation-only, supportive, and adversarial audiences. Shot outcome was withheld during the audience phase by liquid crystal glasses that occluded vision from when the bat struck the ball until just before the next ball was presented. This manipulation was intended to obscure objective information about performance in a manner similar to the occlusion of score employed by Butler and Baumeister. All participants performed their first block of trials in the observation-only condition, with the presentation order of the two remaining conditions counterbalanced across participants.

Procedure

Learning Phase. All participants were instructed to hold the bat with a “shake-hands grip” (Sneyd, 1994, p.22), and were shown a diagram illustrating a topspin forehand drive. Utilizing the same approach as Liao and Masters (2001), the Analogy Learning group was shown a diagram of a right-angled triangle with a bat traversing the hypotenuse and was told that to impart topspin they should contact the ball while bringing the bat up along the hypotenuse (see Figure 2). The Explicit Learning group was given a set of basic techniques on how to hit topspin, which were extracted from two coaching manuals (Sneyd, 1994; The Sport Council, 1995). Both groups were asked to review their instructions before each block of trials and to follow them throughout. No further instructions were given, and at no point was a forehand shot demonstrated to participants.

All participants were informed that the objective was to attain as high a score as possible using only topspin forehand shots. If they hit shots without topspin, they received a score of zero and were reminded that topspin was a prerequisite for scoring.

Transfer Phase. After completing the eighth learning block, all participants performed in a transfer phase. This phase consisted of a block of 50 trials with a concurrent secondary task load (audibly counting backward from 1100 in units of 7) followed by a block of 50 trials without secondary load (baseline).
Verbal protocols were collected at the end of this phase so as to establish the amount of explicit knowledge each participant had accrued during learning.

Audience Phase. The audience phase began with a warm-up, after which the participants were told they would have to perform the remaining blocks with special glasses which occluded visual feedback concerning shot outcome. They were allowed 20 unscored practice shots to become acclimated to the glasses. Pilot testing revealed that 20 shots were sufficient for familiarization under these conditions without hindering performance. The glasses were worn during each subsequent audience block. As in Butler and Baumeister’s studies, in order to raise the difficulty of the task during the audience phase, a “difficult” target score was set for each participant. It was set at 10% greater than the score the participant had achieved in the baseline trial.

Consistent with the procedures outlined by Butler and Baumeister, prior to each condition the participant’s baseline score and target score (baseline + 10%) were presented. These were recorded on a white-board which was placed in full view of the participant. Immediately following each audience block, participants completed the short questionnaire assessing their perceptions of the audience (stressful, supportive, hostile, distracting) and their self-ratings of performance level and effort expended.

In the observation-only condition that began the audience phase, participants were told that four people were observing them via video link-up (in fact only one experimenter was observing them). The presence of a camera directed at the scoring half of the table was indicated, and participants were asked to do their best to attain the target score. For subsequent supportive or adversarial conditions, they were instructed that the audience was using a simplified version of spread betting\(^2\) in order to try to make money based on participant performance. The audience representative placed a stake on whether they thought the participant would (supportive) or would not (adversarial) achieve a certain target score. If the wager was correct, the audience won their stake multiplied by the number of points scored above the target score (baseline + 10%). If the wager was incorrect, the audience syndicate lost their stake multiplied by the number of points scored below the target score. The observation-only audience did not make a bet. In all cases a wager consisted of a stake of £1 (approx. $1.50 U.S.) multiplied by the number of points either above or below the target score, as appropriate.

In the supportive condition, a representative of the fictitious audience recited a standard phrase indicating that, after discussion, the audience had decided to bet for successful attainment of the target. The bet was then written on the white-board beneath the target score, along with the sentence “The audience has bet on you to succeed.” Finally, before leaving the room, the audience representative made a standard supportive comment: “Go on, win us some cash, you’ll do it!”

In the adversarial condition, a different standard phrase was recited, this time indicating the audience had bet that the participant would fail to achieve the

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\(^2\)Spread betting is a modern form of gambling in which two outcomes are proposed. The difference between these outcomes is the spread. The gambler bets on the outcome being either higher or lower than the spread. If the bet is correct, he or she receives the stake multiplied by the number of points above/below the spread, as appropriate. However, if the gambler is incorrect, he/she loses the stake multiplied by the number of points outside the spread.
target score. The bet was written on the white-board below the target, with the sentence “The audience has bet on you to fail.” Upon leaving the room, the audience representative made a standard unsupportive comment: “No chance, you’ll never do it, you’ll mess up.” The order of adversarial and supportive audience conditions was counterbalanced, but all participants performed in front of the observation-only condition first.

Results

Because the sample consisted of both men and women, preliminary analyses of the data were carried out to assess the potential for differential effects of the experimental manipulations across gender. Results revealed no significant gender effects or interactions (all probabilities >.15). Therefore the data were collapsed across gender for all subsequent analyses.

Learning Phase

Task Acquisition. A graphic illustration of task performance during the learning phase is shown in Figure 3 (left side). Acquisition of the table tennis task was examined using a 2 (Explicit vs. Analogy Learning Group) × 8 (Acquisition Trial Blocks) ANOVA, with repeated measures on the second factor. Mauchly’s test of sphericity indicated Greenhouse-Geisser epsilon adjusted probabilities were required. A significant main effect of Trial Block was evident, $F(3.74, 85.93) = 35.14, p < .001, \eta^2 = 0.61$, but the main effect of Learning Group, $F(1, 23) = .28, p > .05, \eta^2 = 0.01$, and the Learning Group × Trial Block interaction, $F(3.74, 85.93) = .99, p > .05, \eta^2 = 0.04$, were both nonsignificant. In short, results indicated that both groups exhibited similar performance improvements, as shown in Table 1.

![Figure 3](image-url)  
**Figure 3** — Mean accuracy scores during acquisition phase, transfer test, and audience phase.
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Transfer Phase

Performance during the transfer phase is also shown in Figure 3 (middle). In order to compare secondary task loading to baseline performance scores in the transfer phase, a 2 (Explicit vs. Analogy Learning Group) × 2 (Baseline vs. Transfer Trial Block) ANOVA with repeated measures on the latter factor was computed. Results revealed a significant main effect for Trial Block, $F(1, 23) = 34.87$, $p < .001$, $\eta^2 = 0.60$, and a significant Learning Group × Trial Block interaction, $F(1, 23) = 10.13$, $p = .004$, $\eta^2 = 0.31$. Tukey’s HSD tests revealed that analogy learners scored similarly on both the baseline and the transfer task, $p > .05$, whereas explicit learners scored significantly lower on the transfer task, $p < .05$. In short, this result indicated that the Analogy Learning group exhibited robustness of performance under secondary task loading, but the Explicit Learning group did not.

Verbal Protocols. Two independent raters, blind to both group and gender, assessed the verbal protocols postlearning. Pearson’s correlation coefficients indicated a high overall interrater reliability ($r = .98$, $p < .01$) so the scores were averaged for analysis. A one-way ANOVA, $F(1, 23) = 79.02$, $p < .001$, $\eta^2 = 0.78$, revealed that the Analogy Learning group ($M = 1.88$ rules, $SD = 1.09$) recorded significantly fewer rules than the Explicit Learning group ($M = 8.62$ rules, $SD = 2.41$), suggesting a low level of metaknowledge in the Analogy Learning group and a high level in the Explicit Learning group.

Audience Phase

Manipulation Checks. Participant ratings of the stressful, hostile, and supportive nature of each audience condition are portrayed in Figure 4. Separate Learning Group × Audience Condition (2 × 3) ANOVAs with repeated measures on the last factor were computed for each component. The supportive and hostile items
required Huynh-Feldt and Greenhouse-Geisser epsilon adjusted probabilities, respectively, as indicated by Mauchly’s test of sphericity. There were no main effects for Learning Group and no significant Learning Group × Audience Condition interactions with regard to items reflecting the audience being stressful, supportive, or hostile. However, a main effect of Audience Condition was revealed for the stressful, $F(2, 46) = 5.39, p < .01, \eta^2 = 0.19$; supportive, $F(1.45, 33.33) = 45.89, p < .001, \eta^2 = 0.67$; and hostile, $F(1.67, 38.51) = 32.92, p < .001, \eta^2 = 0.59$, items.

Follow-up Tukey’s HSD tests demonstrated that participants considered the observation-only condition to be less stressful than the supportive and adversarial conditions, the adversarial condition more hostile than the supportive and observation-only conditions, and the supportive condition more supportive than the adversarial and observation-only conditions (all $p < .05$). These findings can be interpreted as a successful manipulation of the three audience conditions.

Audience Perceptions. A Learning Group × Audience Condition (2 × 3) ANOVA with repeated measures on the latter factor was computed to examine the ratings of distraction, perceived effort, and perceived performance during performance. For distraction, a main effect of Audience Condition was evident, $F(2, 46) = 4.28, p < .05, \eta^2 = 0.16$, but neither the main effect of Learning Group nor the interaction was significant. Follow-up Tukey’s HSD tests demonstrated that participants considered the adversarial audience condition to be more distracting than the supportive and observation-only conditions, $p < .05$. Analyses of the ratings of both perceived effort and perceived performance showed no significant main effects or interactions.

Task Performance. Performance during the audience phase is also shown in Figure 3 (right side). The effects of audiences and learning on performance was assessed utilising a 2 (Learning Group) × 3 (Audience Condition) ANOVA with
Huynh-Feldt epsilon adjusted probabilities and repeated measures on the latter factor. Results of the analysis showed a significant main effect of Audience Condition, $F(1.78, 40.99) = 3.40, p < .05, \eta^2 = 0.13$, and a significant Audience Condition $\times$ Learning Group interaction, $F(1.78, 40.99) = 3.41, p < .05, \eta^2 = 0.13$, but no main effect for Learning Group, $F(1, 23) = .02, p > .05, \eta^2 = 0.00$. To help clarify and interpret the significant interaction shown at the right in Figure 3, post hoc analyses of simple main effects were used to examine audience effects on performance across each learning condition separately. A significant effect was evident in the Explicit condition, $F(2, 24) = 4.58, p < .03, \eta^2 = 0.28$, but not in the Analogy condition, $F(2, 24) = .170, p > .05, \eta^2 = 0.02$. Consistent with hypotheses, follow-up Tukey’s HSD tests demonstrated a performance decrement in the supportive condition compared to both the adversarial and neutral conditions, $p < .05$, for the Explicit Learning group.

Discussion

The main purpose of the present study was to examine the effect of the type of audience on performance of a complex motor skill that was acquired with either a greater or lesser degree of explicit knowledge. Results demonstrated that performance of a difficult skill-based task was disrupted under supportive audience conditions for participants who had learned with a large accumulation of explicit knowledge. In contrast, when analogy learning impeded the acquisition of explicit knowledge, performance remained stable. These findings reproduce and extend those of Butler and Baumeister by demonstrating detrimental effects of supportive audiences for the performance of a complex motor skill in a sport setting.

Congruent with Butler and Baumeister’s results, the absence of a main effect of learning group or an interaction and the presence of appropriate main effects of audience condition for each audience perception check (hostile, stressful, supportive) shows that participants in both learning conditions perceived the audiences similarly and as intended (i.e., supportive or adversarial). Hence the robust performance of the Analogy group cannot be attributed to differential perceptions of the three audience conditions. Furthermore, consistent ratings of effort for both groups across all audience conditions exclude the notion of reduced exertion under supportive audience conditions as a confounding factor. Collectively, these observations allow us to aver that the deleterious effects on performance were derived from the experimental manipulation of learning.

Tests at the end of the learning phase revealed that the Analogy Learning group had learned in a different manner than the Explicit Learning group. Analogy learning was resilient to secondary task loading, as evident in the secondary task transfer test, and was accompanied by significantly less verbalizable knowledge of task performance than the Explicit Learning group, as evident from the verbal protocols. Thus these findings converge to support our hypothesis, providing confirmatory evidence that Liao and Masters’ (2001) analogy learning protocol reduces the acquisition of explicit knowledge.

Contrary to Butler and Baumeister’s findings—wherein performance was underestimated with observational-only and adversarial audiences, but overestimated with supportive audiences—measures of self-perceived performance were consistent across both group and audience condition. Two explanations could account for this. First, despite the curtailment of visual feedback, the imprecise audi-
tory feedback may have been enough to allow some estimate of performance that was similar for both groups in each audience condition. Alternatively, the absence of any visual feedback here differs markedly from Butler and Baumeister’s manipulation in which visual feedback was available continuously; they only restricted information about the final score of participants. What the data here suggest is that performance estimates across the different audience conditions are similar when the normally available visual information about outcome is precluded.

The primary findings of the present study revealed that performance of a difficult skill-based task was disrupted under supportive audience conditions for participants who had learned with a large accumulation of explicit knowledge. In contrast, when analogy learning impeded the acquisition of explicit knowledge, performance remained stable. Several issues arising from these findings should be highlighted.

One issue of potential interest concerns why performance was curtailed for participants in the Explicit Learning group but not in the Analogy Learning group. As noted above, the latter group displayed minimal evidence of explicit knowledge about the motor task. This finding suggests that the two groups were situated at opposite extremes of the continuum representing skills learned with either a greater or a lesser degree of explicit knowledge. Both groups accumulated implicit knowledge during learning, but only the Explicit Learning group acquired substantially more metaknowledge or verbalizable rules of task execution. Research has shown that, under stressful conditions, the performance of skills learned without metaknowledge remain intact whereas performance is disrupted if substantial metaknowledge was acquired during learning (Hardy et al., 1996; Masters, 1992; Maxwell et al., 2000, 2001; Rathus, Reber, Manza, & Kushner, 1994).

Masters (1992, 2000) argued that without metaknowledge of the parameters of the movement that allow the performer to interfere with the hierarchical sequencing and organization of the motor commands as the skill is executed, the act can run off without disruption. Put simply, conscious control over movement can only occur if explicit rules are available to be consciously processed. Therefore, in the present study, any efforts to consciously control movement were likely to be more pronounced in the Explicit Learning group.

Another major issue relates to the question of why, in both the present study and in Butler and Baumeister’s (1998) study, was only the supportive-audience condition deleterious to performance? This finding runs counter to the intuitive assumption of most sport fans that their “booing” a performer or team should hurt performance, not their cheering them on! Self-presentation offers a compelling explanation. Although we cannot confirm that self-presentational concerns and self-focused attention were heightened in the present study, we can infer this from previous work. Self-presentational concerns have been shown to be more salient in the presence of supportive audiences (Baumeister, Hamilton, & Tice, 1985; Leary, 1992; Tesser et al., 1989) and have also been shown to engender heightened levels of self-focused attention (Hull & Levy, 1979; Schlenker & Leary, 1982).

One theory-based explanation for why self-presentational concerns disrupt performance under supportive-audience conditions is available in the model of attention and action proposed by Norman and Shallice (1986). In this model, the default mode of automatic control can be overridden by the supervisory attentional system (SAS). An internal focus of attention is one function for which the SAS is responsible. In situations when automatic control is identified as either inappropri-
ate or inadequate, the SAS can override automatic control with conscious attention. When there is considerable motivation to perform a motor task successfully, conscious step-by-step control of the action can be initiated by the SAS, even though this can disrupt performance.

The absence of performance failure under adversarial audience conditions can also be accommodated by Norman and Shallice’s (1986) model. One possibility is that self-presentational concerns were lower in the adversarial condition than in the supportive-audience condition, and hence the override of the SAS was not triggered. Perhaps of more importance, because the adversarial condition was regarded by participants as the most distracting of the audience conditions, it is reasonable to infer that the SAS was preoccupied with processing the cognitions associated with distraction. Therefore, its limited capacity may have been insufficient to override automatic control of movement production and thus performance was unaffected.

The results of a study by Lewis and Linder (1997) support this line of reasoning. They found that a distractor task (backward counting) alleviated performance decrement under conditions of stress by preventing self-focused attention. Allard and Burnett (1985) interpreted their findings in a similar way when discussing work by Burnett (1983) which showed that expert batters in baseball did significantly better than normal when they performed a secondary task requiring them to recall the color and location of ribbons on the wrist, elbow, and upper portion of the pitcher’s delivery arm. According to Allard and Burnett, results showed that “it is almost as if giving the declarative system of experts something to keep it busy makes it easier for the procedural system to get down to business” (p. 310). In many respects this is what professional athletes do when, for example, they employ a pre-shot routine to aid performance under pressure (e.g., Boutcher & Crews, 1987). That is, they preoccupy mind with information, freeing the motor system to execute the act without interference.

The present study was the first to examine conscious control over movement as a possible explanation for performance decrements in the presence of supportive audiences. However, there is some evidence from the Butler and Baumeister study to corroborate the notion that increased conscious control over action is more likely to occur in the presence of a supportive audience than an adversarial audience when the criterion for success is difficult. Butler and Baumeister showed that supportive audiences made marginally more self-referent statements (Experiment 2) and scored higher on a measure of self-awareness (Experiment 3). A recent qualitative study by Bawden and Maynard (2001) examining the occurrence of extreme forms of choking in cricketers provides further evidence of this route to skill disruption. Those authors concluded that factors such as self-presentational concerns made the cricketers more self-conscious about their performance and led them to try to consciously control their movements.

Although the results of the present study contribute to our understanding of the processes through which supportive audiences can have a paradoxical negative effect on skilled motor performance, the study is not without its limitations. One concerns the lack of direct measures of both state attentional focus and state self-presentational concerns. As a consequence, we had to infer part of the route from supportive audience to performance failure based on previous findings. Future studies should address this issue by including such measures. Another limitation concerns the audience manipulation, which although successful in an
experimental setting, is not analogous to a real-world audience at a sporting event. Future work could try to create more ecologically valid audience conditions such as having groups of spectators interact directly with participants as they perform in the experimental setting. Furthermore, our results relate to a skill that was acquired over 400 trials. Although it appeared that asymptote was reached, the completion of 400 trials is not comparable to the extensive practice of highly trained athletes. It would therefore be imprudent to use these findings to predict performance in naturalistic situations.

In light of these caveats, cautious interpretation of the results is recommended. Nonetheless, some generalizations of the present findings to real-world situations may be possible. For example, one can imagine a child athlete suffering the ignominy of performance failure during an important match while being supported by proud and well-meaning parents or coaches. The development and implementation of analogy learning methodologies, similar to the one used in this study, as standard coaching practice could help prevent potential choking situations throughout a young athlete’s career.

The use of errorless learning (Maxwell et al., 2001) would provide an alternative means for inducing the acquisition of skills without extensive explicit knowledge. In the errorless learning paradigm, learners are discouraged from testing hypotheses about skill execution, thus restricting their explicit knowledge base. Eventually, if critical skills are acquired with a limited explicit knowledge base, it could mean the difference between success and failure at critical moments in sport, such as soccer penalty kicks in front of the hometown crowd.

In conclusion, the present study showed that supportive audiences can have a negative effect on performance when a skill is learned with higher levels of explicit knowledge. When the same skill is learned by analogy, however, performance does not suffer under supportive audience conditions. The pattern of findings supports the interpretation that self-presentational concerns heighten self-focused attention which draws upon one’s knowledge of the skill he or she is performing. Therefore, having a large amount of explicit knowledge may be a liability for performance. Alternatively, analogy learning may be an effective means of acquiring skilled task proficiency which offers greater performance resiliency, at least under conditions that may heighten self-presentational concerns.

References


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