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A review of paradoxical performance effects: Choking under pressure in sports and mental tests

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Abstract

Paradoxical performance effects ('choking under pressure') are defined as the occurrence of inferior performance despite striving and incentives for superior performance. Experimental demonstrations of these effects on tasks analogous to athletic performance and the theories that may explain them are reviewed. At present, attentional theories seem to offer the most complete explanation of the processes underlying paradoxical performance effects. In particular, choking may result from distraction or from the interference of self-focused attention with the execution of automatic responses. Experimental findings of paradoxical performance decrements are associated with four pressure variables: audience presence, competition, performance-contingent rewards and punishments, and ego relevance of the task. The mediating factors of task complexity, expectancies, and individual differences are discussed.

INTRODUCTION

The present review draws together the experimental demonstrations of paradoxical performance effects and the theories that have been put forward to explain them. By paradoxical performance effects we mean the occurrence of inferior performance despite striving and incentives for superior performance. Colloquially, these phenomena are called 'choking under pressure'.

Our task faces several obstacles. First, only a very few studies have explicitly tried to demonstrate choking effects. Second, many of the effects are scattered among a variety of topics in the literature, often because they were not predicted. Third,

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unforeseen choking effects may have been subjected to capricious *post hoc* explanation, or at least explanation according to whatever theory was most readily available. The current dispersed state of knowledge about paradoxical performance effects could be improved if the various relevant theories were compared and integrated, and if past findings of such effects were brought together. The present paper undertakes such a synthesis.

DEFINITIONS

Pressure is defined as the presence of situational incentives for optimal, maximal, or superior performance. Pressure has a subjective component: The performing individual must know about the incentives for superior performance. Forms of pressure include the contingency of rewards or punishments on level of performance, the presence of an evaluative audience, the presence of comparative coactors (competition), the extent to which performance reflects on important features of the self ('ego relevance'), and the likelihood that one will not have a second chance. These factors may appear singly or in combination. When they occur together their effects are presumably additive.

Choking is defined as the occurrence of suboptimal performance under pressure conditions. A given performance can be said to constitute choking only if one can be reasonably certain that the performer could have done better. A single missed kick, for example, can almost never be unequivocally interpreted as choking, for such misses can always occur. Although choking cannot usually be established objectively in the single case, we emphasize that choking is in its essential nature a matter of a single performance. Pressure by definition focuses on a single, present performance. To say that a team 'choked' in a championship series of games is to say that pressure interfered with their performance on many single occasions and moments during that series.

Additionally, it is inherent in the definition of choking that the performer wants to perform well, although some degree of ambivalence may be present. If the performer is not motivated to perform well, poor performance is not choking; indeed, the person in that case is not under pressure. At times, people may deal with a distressing pressure situation by withdrawing effort from the task at hand (e.g. Jones and Berglas, 1978; Carver and Scheier, 1981a, 1982). In such a case, inferior performance is clearly not an instance of choking.

It is important to distinguish the present use of the word 'performance' from that which is seen in psychological literature on topics such as learning of tasks, achievement, task performance, and test anxiety. The present definition of performance is broad and *situational*: An individual is performing whenever he or she carries out a task in a situation that calls for an optimal outcome. Performance situations imply a goal of immediate, maximal achievement. They are clearly distinguishable from practice situations where the goal is usually long-term improvement in skill.

Most other definitions distinguish performance from learning on the basis of the individual's acquired skills. The *asymptotic* definition uses levelling-off of the learning curve as the criterion for performance. At that point, successive task trials fail to yield consistent and marked improvements in score. Some authors use a *dominant*

response criterion, operationalizing performance trials to be those that are carried out after the correct response occurs more than any other (or, simply, more than 50 per cent of the time).

Our situational definition of performance has the advantage that it can be applied to persons with any level of skill. Although pre-teen tennis players and young student athletes are certainly hoping to learn and improve, they still may perform in matches or tournaments. On such occasions, learning is not the goal; maximal performance is. By the same token, a football player does not regard his chance to play in the Super Bowl (the American football championship game) as a last chance to learn new skills for next season's preseason games; the Super Bowl is a performance regardless of any player's level of development or potential for future improvement. When performing under pressure to do well, novices who are not especially skilful at a task may choke in comparison to their *current level of ability*. In fact, unskilled persons may be especially vulnerable to paradoxical pressure effects, as will be discussed later.

THEORIES

The theories that have been put forward to explain phenomena similar or relevant to choking can be grouped in two classes. One is based on alterations in the performer's *attentional focus* or processes. At present, it is probably safe to say that some form of attentional theory is widely preferred. While *drive theories* do not provide a complete explanation of the processes underlying choking effects, we present them here because they have been invoked to explain many of findings cited and, hence, they constitute a large portion of the current understanding of performance effects.

Drive theories

Drive theories hold that a key determinant of performance is the performer's level of arousal. In applying these theories to performance under pressure, we interpret increased subjective motivation to do well as an increased level of arousal or 'drive'. There are two versions of drive theory. The first postulates an inverted-U relation between drive and performance, which means that performance is best at intermediate levels of drive. The second, which we cover below, is dominant-response theory.

Because situational pressure can be assumed to result in increased drive, the inverted-U theory is intrinsically plausible as an explanation for choking. Inverted-U theories often refer to the Yerkes–Dodson effect, based on those researchers' (1908) finding that rats learn to discriminate 'safe' from 'unsafe' areas most quickly when punished with intermediate levels of shock.

Drive theories have been criticized as having limited predictive utility and as being vague. (To some extent, these criticisms reflect changes in the styles of explanation preferred by the research community.) They are essentially descriptive, 'black box' models that do not attempt to explain the actual processes which link the arousing stimulus with the subject's performance. Recently, process-oriented models have been proposed as better explanations for several phenomena that have traditionally been described in drive terms (e.g. Blank, Staff and Shaver, 1976; Bond, 1982). Although certain factors or experimental manipulations are assumed to increase drive, drive has never been well operationalized. There are no *direct* or *absolute* measures of drive. On a given task, it is hard to predict what amounts of what factors will lead to

sufficient drive that performance will start to deteriorate. This problem can be seen by considering that not everyone chokes in the World Cup Championships, Olympics, or Super Bowl; inverted-U theories do not explain that fact. We can force the model to fit our observation by hypothesizing that the various athletes in such contests have widely different degrees of motivation to succeed, or that the point at which performance starts to deteriorate is idiosyncratic. However, drive theory itself does not implicate any such explanations, nor help us evaluate them. The fundamental inadequacy of the drive approach (as judged by current standards and attitudes among researchers) is that it does not speak to the *processes* that debilitate performance.

The concept of drive is sometimes clarified by interpreting it as physiological arousal. However, the gain in conceptual clarity is offset by evidence that physiological arousal is not a generalized, global process and by the failure to find truly valid physiological indices of arousal (Lacey, 1967). As Bandura (1977) has pointedly argued, changes in bodily arousal are neither necessary nor sufficient to account for observed changes in performance and if both changes occur together they should be regarded as coeffects. Despite the difficulties of obtaining and interpreting physiological data, a number of authors have collected physiological measures (usually palmar sweat) for performance in pressure situations, with mixed results (e.g. Carver and Scheier, 1981b; Church, 1962; Martens, 1969a,b; Paulus, Annis and Risner, 1978). Indeed, Carver and Scheier (1981b) showed that it makes a decisive difference whether the arousal measure is obtained before, during, or after the actual performance, because concentration on a task reduces palmar sweat. Thus, much of the evidence relating arousal to performance is not only conflicting but methodologically inadequate (Carver and Scheier, 1981b).

The Easterbrook hypothesis is one version of drive theory that postulates a cognitive process underlying inverted-U effects. Easterbrook (1959) argued that increasing emotional arousal reduces the range of cues used in a task. This implies increased concentration on task-relevant cues up to a point, as long as irrelevant cues are being disregarded; past that point, attentional focus is so narrow that even task-relevant cues begin to be ignored. This cognitive process could account for an inverted-U relationship between arousal and task performance. In other words, the non-aroused goalkeeper may think about the fans' reactions as well as catching the ball, and therefore allow a goal; the moderately aroused goalkeeper follows the game closely and may tend to perform well; but the highly aroused goalkeeper may fail to compensate for the high bounce off an artificial surface, so he misjudges the ball and allows a goal. An important advantage of the Easterbrook hypothesis is that it can predict and explain both decrements *and* improvements caused by performance pressure (e.g. Bruning, Capage, Kozuh, Young and Young, 1968).

Easterbrook's introduction of a cognitive process to explain impaired performance and more recent elaborations on it (Broadbent, 1971) remove these theories from the realm of pure drive theories. Spence and Spence (e.g. 1966) are drive theorists who incorporated attentional factors in their explanation of anxiety's effects on performance[1]. Such modifications of drive theory are a start at formulating a more attentional and process-oriented theory of choking.

[1]Attentional processes have also been linked to the drive theory of social facilitation by Sanders (1981) and Sanders and Baron (1975). However, these authors use attentional factors to explain drive induction, not its effects on performance.

The second class of drive theories is dominant response theories. They hold that increased drive accentuates the likelihood that the dominant response will occur. Probably the best-known modern use of this theory is Zajonc's (1965) theory of social facilitation, explaining why the presence of an audience improves performance on well-learned tasks but harms performance on poorly-learned tasks. Success is the dominant response on a well-learned task and failure is the dominant response on an unfamiliar or poorly-learned task. Increased drive presumably accentuates the dominant response.

This form of dominant response theory can certainly account for some instances of choking, but it seems inadequate for a general model. For example, professional (and college) basketball players tend to make more than half their free throws, so scoring the point is the dominant response. Dominant response theory therefore cannot easily explain why a player could choke under pressure and miss some decisive shots in the championship game (*cf.* Baumeister and Steinhilber, 1984, for evidence of choking on free throws).

Broen and Storms (1961) proposed a reformulation of dominant response theory that makes it better able to account for such phenomena as choking, although an increase in predictive vagueness may be the cost of this improved explanatory capability. These authors suggested that each response has a 'response potential ceiling'. Increasing drive increases the likelihood of the dominant response, but only up to a point (the 'ceiling'). Past that point, further increases in drive are channelled into energizing other responses, so the likelihood of nondominant responses (e.g. kicking over the goal) is increased. Broen and Storms' formulation is flexible enough to handle choking phenomena but its usefulness is severely hampered (again) by the vagueness of the concept of drive. If drive could be operationalized and response potential ceilings could be specified, it would be possible to test this model in the context of sports performances. However, dominant response theory still does not explain the actual psychological processes that cause performance decrements.

Attentional theories

Attentional theories explain choking by postulating some interference with the performer's attentional processes. Effective performance requires attending to certain information, processes, and behaviours, and excluding other factors. Therefore alterations in cognitive processing and attentional focus can lead to ineffective performance.

Attentional theories may be crudely separated into two types, which overlap to some degree. *Distraction* theories postulate that choking occurs because the performer fails to attend to and utilize information necessary for the performance. The other type is concerned with *self-awareness*.

Distraction involves attending to task-irrelevant cues. Obviously, if the tennis player does not see the ball, he will not hit it. Even a momentary inattention to the ball's trajectory could reduce the likelihood of making contact with it when it arrives. Tennis teachers admonish their pupils to keep their eyes on the ball, presumably in the belief that momentary inattention is a major cause of missed shots.

Distraction may involve either of two processes: (1) The performer ceases to filter cues selectively and attempts to process an increased amount of information, thereby failing to give adequate attention to task-relevant cues; (2) The performer processes a normal amount of information, but shifts his focus of attention to task-irrelevant cues, thereby neglecting critical features of the task. Either way, if task-irrelevant

cues capture a performer's attention and lead him to neglect task-relevant events and stimuli, they may cause performance decrements. Easterbrook's (1959) hypothesis that increased motivation causes a steady decrease in the number of cues utilized, leading first to improved processing of task-relevant information but eventually interfering with it, implies that the aroused state itself diverts cognitive capacity from processing external stimuli.

One type of task-irrelevant attention that may divert attention from task-relevant information is worry (e.g. Morris and Liebert, 1969; Doctor and Altman, 1969; Eysenck, 1979; Kahneman, 1973; Spence and Spence, 1966). In particular, Wine (1971) and Sarason (1972) have offered an interpretation of test anxiety effects in terms of worry. Test anxiety, it must be noted, is a valuable complement to sport research for studying choking, because it usually presumes a test-taker who wants to do well but fails under pressure. (Test anxiety research is also concerned with effort withdrawal as a response to pressure, but this phenomenon is beyond the scope of this paper). In the accounts of Sarason and Wine, highly anxious persons become preoccupied with task-irrelevant thoughts (e.g., 'I can't remember anything, what if I fail, I'm too stupid') and consequently cannot engage in the cognitive processing that would enable them to demonstrate their knowledge on the test. (It must be noted that the specific task-irrelevant worries discussed by these authors do pertain to evaluation of the self, so at this point the distraction and the self-awareness explanations of choking overlap.) Task-irrelevant processing can explain many instances of choking. Increased pressure is the increased importance of doing well, and this importance likewise furnishes all the more for the person to worry about. The fact that some people choke when others do not choke could be explained on the basis of individual differences in the predisposition to worry (or, more broadly, to have task-irrelevant cognitions) and in coping with worry. Cognitive therapies for test anxiety have improved performance by substituting task-focused and anxiety-coping cognitions for task-irrelevant ones (e.g. Meichenbaum, 1972). In a similar way, keeping one's eyes on the tennis ball may focus attention on a task-relevant cue rather than on 'worry' cognitions which are irrelevant to skilful performance. Distraction does not always impair performance. Sanders and Baron (1975) showed that sometimes distraction can actually improve performance, because the distraction initiates some sort of compensatory process in the performer (e.g., increased effort). Sanders and Baron discuss their findings in terms of drive theories. It would be valuable if subsequent researchers would study the attentional mechanisms that mediate the distraction-facilitation affect. Ultimately, distraction theories might be able to explain and to predict both the decrements and the occasional improvements in performance that are caused by pressure.

Self-focused attention has been hypothesized to interfere with optimal task performance in a number of ways. One model was proposed by Baumeister (1984). He suggested that pressure makes the person want to do well, so the performer focuses conscious attention on the process of performance. Unfortunately, skills are responses that are overlearned and automatic; attending to them consciously simply interferes with or inhibits them (*cf.* Kimble and Perlmuter, 1970). Thus, whereas a skilled basketball player could *automatically* move his hands so as best to catch the ball, if he tries to control his hand movements *consciously* he will find that he does not consciously know how to move them, with the result that he may misalign them and drop the pass.

Another model for the performance-harming effects of self-awareness was proposed by Carver and Scheier (1981a). They argued that consciousness functions to raise alternative possibilities. Attending to oneself when performing, therefore, makes possible a number of responses other than the optimal one. They felt that the self-conscious performer would be able to execute the optimal response if given enough time; but of course many performances do not offer the luxury of adequate time. A self-conscious basketball player cannot review all possible hand positions while the ball is in the air coming toward him. Thus, in these authors' view, the harmful effects of self-awareness derive from its tendency to slow performance down. It is consistent with Bond's (1982) conclusion that the presence of others (which may increase self-focus, Carver and Scheier, 1978) impairs performance of a complex task by reducing speed and accuracy. However, some authors (e.g. Liebling and Shaver, 1973; Wicklund and Duval, 1971; Zimring, 1983) have shown that increased self-attention can *increase* speed of performance (often at the expense of accuracy). Although such evidence tends to contradict the idea that self-awareness causes choking by slowing performance down, it would be premature to reject that idea until more research has been done. It is plausible that, in some situations or on some tasks, self-awareness does retard the speed of performance processes.

Finally, it must be noted that some formulations of self-awareness theory (Duval and Wicklund, 1972; see also Scheier, Fenigstein and Buss, 1974) have held that attention to self and attention to the environment are mutually exclusive. If correct, this could imply that self-conscious performers are not attending to their tasks, and inferior performance could follow from this failure to process task-relevant information (*cf.* Liebling and Shaver, 1973). Thus, again, the task-irrelevant information explanations and the self-awareness explanations for choking may overlap.

EXPERIMENTAL DEMONSTRATIONS OF INDUCED PERFORMANCE DECREMENTS

We turn now to review the evidence of choking effects, that is, instances of impairment of performance under circumstances that seemingly call for improvement in performance. Unfortunately, there are relatively few studies that have explored choking effects dealing with athletic performance. Therefore, we shall include evidence of performance decrements on cognitive performances along with those on athletic or skilful performances. There is substantial overlap; for example, performance decrements on reaction time tasks seem like cognitive deficits, yet reaction time is of critical importance to many sports.

We group the experimental demonstrations of performance decrements by the pressure variables[2].

[2]In all the studies reviewed here, it seems reasonable to assume that subjects are responding to pressure with an increased subjective level of motivation. However, in some situations, it is possible that performers may respond to extreme pressure by withdrawing effort. Effort withdrawal has been associated with the phenomena of self-handicapping and learned helplessness. Most of the performance situations in the studies presented here do not involve extremely weighty consequences nor the repeated failure experiences that are likely to lead to effort withdrawal. Nonetheless, future research must take care to distinguish instances of effort withdrawal from choking.

Competition

Explicit competition occurs when subjects are clearly informed that their performance will be compared with the performance of others, at least some of whom are coacting. Implicit competition arises when subjects will tend to compare their performances with those of coactors even though no explicit competitive arrangement is made. Pressure is constituted by either explicit or implicit competition, insofar as the performer desires to compare favourably with the other performers.

Church (1962) found that explicit competition increased errors on a reaction time discrimination task, as compared with mere (noncompetitive) coaction. Competing subjects were faster but less accurate than noncompeting subjects. Shaw (1958) showed performance decrements on a complex coordination task and concept formation when subjects were competing. Seta, Paulus and Risner (1977) showed that making competition explicit harmed performance on complex maze tasks.

Two studies have suggested that choking may be caused by implicit competition. Sanders, Baron and Moore (1978) demonstrated performance decrements on a complex copying task (but not a simple task) when subjects were comparing their performances with coactors. They suggest, however, that watching the coactor distracted subjects from their own performance, and if the performance decrements were indeed due to such distraction it is not clear whether they should be interpreted as choking. Baumeister (1984, Experiment 4) found choking on a skilful coordination task (roll-up game) due to implicit competition. His male subjects choked when paired with a female confederate, posing as another subject, who consistently performed slightly better than the subject. Choking was not found when the confederate performed worse than the subject or when the subject was dispositionally high in self-consciousness. The finding regarding the level of the confederate's performance is illuminated by Seta's (1982) work. Seta showed that motivation to excel is increased when one's performance is slightly lower than the performance of one's competitor(s) and when outcomes are public. These circumstances were the ones that elicited choking in Baumeister's study.

Thus, there is some evidence that both explicit and implicit competition can elicit choking on tasks that model elements of skilful athletic performance.

Reward contingency

It is important to perform well when rewards are made contingent on performance level. Therefore, contingent rewards constitute pressure.

Baumeister (1984, Experiment 5) demonstrated that subjects who were offered a cash incentive for improved performance actually did worse than subjects who were not offered any money. The task in that experiment (the roll-up game) was chosen as a direct analog to coordinated, skilful aspects of performance in sports.

McNamara and Fisch (1964) showed that incentives ironically impaired performance on a variety of attentional tasks, involving both scanning and attention span. It appears that contingent rewards interfere with the attentional aspects of performance. Deficits in children's discrimination (learning) due to offering incentives were similarly demonstrated by Miller and Estes (1961) and McGraw and McCullers (1974).

Attention and discrimination seem relevant to some types of athletic performance. Reward-induced choking has also been shown on several purely cognitive tasks that

are not clearly relevant to athletic performance. These include problem-solving insight (Glucksberg, 1962; McGraw and McCullers, 1976) and concept formation (Terrell, Durkin and Wiesley, 1959; their effect did not obtain with lower-class children). Paul and Eriksen (1964) showed that subjects with high test anxiety performed worse on a regular course examination than on a special test that 'didn't count', that is, a test on which the subject's course grade was not contingent.

Earlier we noted the suggestion that competition sometimes may harm performance due to distraction. A similar argument has been made regarding rewards (e.g. Haddad, McCullers and Moran, 1976; McGraw and McCullers, 1974; Miller and Estes, 1961). Attending to or thinking about the possible reward may hamper the performance on which the reward is contingent. Reward contingencies may also interfere with performance by undermining intrinsic motivation (e.g. Deci and Porac, 1978; Lepper and Greene, 1978), although rewards that are contingent on performance and that convey diagnostic, evaluative information to the performer seem not to reduce intrinsic motivation (Karniol and Ross, 1977; Rosenfield, Folger and Adelman, 1980).

Punishment contingency

Pressure is constituted by punishment contingency because it becomes important to do well when poor performance will be punished. We found no experimental studies of choking on sports or sports-related tasks that used contingent punishment as the pressure variable. Either such variables do not reliably produce choking on athletic tasks, or research has not addressed the issue. We emphasize, though, that it is not proper to assume the effects of punishment contingencies will be the same as those of reward contingencies, at least in regard to athletic performance. A team or athlete facing possible elimination from a tournament (punishment) will feel and perform differently from a team or athlete on the brink of winning the championship (a reward) (Baumeister and Steinhilber, 1984).

Several studies have demonstrated that contingent punishments (usually electric shock) can lower performance on purely cognitive tasks, including easy serial learning (Deese, Lazarus and Keenan, 1953), paired-associates learning (Besch, 1959), and mazes (Agnew and Agnew, 1963).

At present, the power of contingent punishment to elicit choking has not been shown as clearly and consistently as that of contingent reward.

Ego relevance

Several experiments have put pressure on subjects by presenting the task as diagnostic or evaluative. In most of these, the experimental task is described as a measure of intelligence, and the subjects are college students. Students wish to have high intelligence and therefore are presumably more motivated to excel on an alleged intelligence test than on the same task presented as nondiagnostic. Presumably, this type of instruction creates pressure by making task performance reflect upon some important feature of the self.

Presenting the task as ego-relevant has led to choking on a variety of cognitive tasks, including solving anagrams (Deffenbacher, 1978; Sarason, 1961; Vogel, Raymond and Lazarus, 1959), digit span (Dunn, 1968), serial learning (Nicholson, 1958; Sarason, 1956), digit symbol (Sarason and Palola, 1960), verbal coding

(Katchmar, Ross and Andrews, 1958), and paired-associates learning (Taylor, 1958).

Although ego relevance has only been studied in the domain of cognitive tasks, it is inherent in most athletic competitions. A competing athlete is likely to have an image of himself as skilful at performing that sport. Hence, doing well will almost always be ego-relevant. When an athlete experiences pressure due to other variables we have discussed, she may see the upcoming performance as reflecting even more strongly on the self. Thus, ego relevance may be a common factor underlying other pressure variables.

It is plausible that increasing the ego relevance of a performance increases one's self-focus. If this is true, the theory that choking is a result of attentional processes associated with self-awareness is supported by the literature cited above.

Audience

The presence of an audience causes the performer to be concerned with how the audience will think of him (Baumeister, 1982; Schlenker, 1980). Important performances define the self as successful and capable or as unsuccessful and incompetent, and the audience (as witness) makes these self-definitions into public, confirmed reality. The audience therefore adds to the importance of performing well (*cf.* Schlenker and Leary, 1982) and in that sense increases pressure.

Although most research has simply contrasted audience-present versus no-audience situations, different audiences may create different amounts of pressure. Seta and Seta (1983) have theorized that the importance of performing well is a function of the number of people in the audience, the salience of the audience, and the status level (relative to the performer's status) of audience members. Moreover, the audience's attitudes and expectations about the performance may also increase or decrease the pressure (e.g. Baumeister, Hamilton and Tice, 1985; Baumeister and Steinhilber, 1984). Thus, the audience is not a simple, homogeneous, or dichotomous variable in relation to performance pressure.

Martens and Landers (1972) found that having one's performance observed led to poorer performance than if the performance were not directly observed but the score would still be public. They used a coordination and skill task (the roll-up game) which as we have suggested is quite analogous to some athletic skills. It must be noted, however, that the 'audience' in Martens and Landers' study consisted of coactors rather than pure spectators, so some elements of implicit competition might have contributed to the pressure. Sasfy and Okun (1974), however, showed audience-induced performance decrements on the roll-up task.

Baumeister (1984, Experiment 6) used audience pressure in a field study with video games, which require skill, coordination, discrimination, and timely reactions (as do many athletic performances). Among skilled players, Baumeister found an average drop in score of 25 per cent from the previous (unobserved) trial to the audience-present trial.

Paulus, Shannon, Wilson and Boone (1972) demonstrated performance decrements caused by audience presence. Their study is particularly valuable because it used authentic athletic performance, namely gymnastics performance. Curiously, they only found the performance decrements when subjects were advanced in skill and were warned one to ten minutes in advance of the performance that an audience would

be present. In a separate experiment, introductory gymnastics students who were not warned of audience presence did not show performance decrements.

Another field study showed performance decrements caused by the presence of spectators (Forgas, Brennan, Howe, Kane and Sweet, 1980). Both expert and novice squash players tended to choke when the audience was there. Moreover, the audience effects were not dependent on any sort of advance warning, unlike in the study by Paulus *et al.* (1972).

Thus, the presence of an audience can cause choking on performances that are analogous to athletic performances. Audience presence has also been associated with performance decrements on tasks less directly similar to athletic performance, including maze performance (Rajecki, Ickes, Corcoran and Lenerz, 1977), mirror drawing (Innes and Young, 1975), concept attainment (Laughlin and Jaccard, 1975), verbal learning (Berkey and Hoppe, 1972; Bond, 1982, Cottrell, Rittle and Wack, 1967; Innes and Sambrooks, 1969), digit span (Quarter and Marcus, 1971), and public speaking (reviewed in Paivo, 1965). Indeed, the extensive study of social facilitation has been centrally concerned with the disruption of performance, especially on complex tasks, by the presence of others. Although Bond and Titus (1983) present a thorough analysis of this literature, it will be useful here to review alternative theories of social facilitation and their relevance to choking.

Traditionally, there have been two explanations for social facilitation. One is that the mere presence of others is sufficient to affect performance (Rajecki *et al.*, 1977; Zajonc, 1980, 1965). The other is that performance is mainly affected by the evaluative potential of an audience, not the mere physical presence of others (Cottrell, Wack, Sekerak and Rittle, 1968; Geen, 1973, 1974; Geen and Gange, 1977; Henchy and Glass, 1968; Weiss and Miller, 1971). Both views have received some support, although Bond and Titus's meta-analysis (1983) suggests that a potentially evaluative audience has no greater effect on task performance than the mere presence of others. Of course, it is possible that people respond to mere presence *as if* evaluation were possible, and that evaluation apprehension is the psychological source of performance effects in either case. A performer who experiences audience-induced pressure clearly is responding as if the audience can evaluate him.

More recent theories of social facilitation emphasize self-awareness (Duval and Wicklund, 1972; Carver and Scheier, 1981a), self-presentation (Blank *et al.*, 1976; Bond, 1982), or social monitoring and comparison (Guerin and Innes, 1982; Guerin 1983; Sanders *et al.*, 1978). Except for the self-awareness theories and Blank *et al.*'s paper, these recent approaches rely heavily on drive theory to 'explain' performance effects. Their contribution is simply to specify the psychological sources of drive, respectively, as inferred failure, presence of unpredictable or unfamiliar others, or distraction-conflict. In sum, the social facilitation literature mirrors our observations about the available theories for choking: Attention literature which emphasizes self-awareness offers the most complete explanation of the process underlying performance effects; drive theories, though widely used to 'explain' experimental findings, are vague and incomplete when evaluated from the current perspective which favours process-oriented explanations of behaviour.

Audience effects are especially interesting in the domain of athletic performance where huge groups of highly involved, partisan spectators are common. As with other pressure variables, the audience effects found in a psychological laboratory may not be ecologically valid for typical athletic performances. For example, the

pressure-inducing effects of an audience may be counterbalanced by the typically *supportive* attitude of a home crowd. Additionally, home teams may be more susceptible than visitors to audience effects because audience responses of clapping and cheering are contingent on the deeds of the home team.

Specific evidence on the effects of sports audiences on athletic performance was provided in two archival studies by Baumeister and Steinhilber (1984). They reasoned that self-consciousness would be maximal, and therefore choking would be most common, when performers had the chance to claim a desired identity (by winning a championship) at their home stadium. Study I showed that home teams tend to win the early games of the World Series (American baseball championship) but tend to lose the final decisive game. Study II showed the same pattern for championship series in the (American) National Basketball Association. Supplementary findings suggested that the home team does in fact tend to choke in the decisive game, as evidenced by increased fielding errors and by missed free throws (see also Baumeister, 1985).

Audience effects may be intensified when the audience is physically close to performers (e.g. in basketball as opposed to baseball), when the audience is large, and when it is vociferous. Despite the abundant literature on audience effects, it is necessary to collect data on complex combinations of audience factors to understand how an audience contributes to choking.

Summary

Audience presence, competition, and contingent rewards seem to induce paradoxical performance decrements on tasks analogous to athletic performance, as well as on other tasks. Contingent punishments and ego relevance have been shown to harm cognitive performances and cognitive learning, but their capacity to interfere with athletically relevant skills has not apparently been demonstrated.

MEDIATORS OF CHOKING

Although there are many instances of choking in both the psychological literature and everyday experience, pressure need not always impair performance. Sometimes performers seem to benefit from pressure to their advantage. In this section, we explore three kinds of mediators of paradoxical pressure effects: task complexity, expectancies of success and failure, and individual differences in susceptibility to pressure or performance effects.

Task complexity

Pressure may be especially likely to interfere with certain kinds of tasks. Literature on task performance sometimes distinguishes task difficulty (likelihood of correct or successful performance) from task complexity (a characteristic of the skills or processes needed to perform the task) (Weiner, 1966). Most theories of choking predict that performance on a difficult or complex task is especially likely to be impaired (e.g. by distraction, worry, or energization of the dominant response). Some studies demonstrate choking on a difficult or complex task and improved performance on

an easy or simple task, given the same pressure variable (Cottrell *et al.*, 1967; Vogel *et al.*, 1959). However, there are numerous exceptions (*cf.* Bond and Titus, 1983) and even extremely simple or easy tasks can be subject to decrements under extreme pressure.

Efficacy expectancies

A performer's response to pressure may be mediated by his *expectancy* of success or failure, possibly based on prior experience. More precisely, the crucial element is the performer's belief about whether he or she can successfully execute the behaviour necessary to produce the desire outcome. These beliefs have been termed efficacy expectancies (Bandura, 1977). The debilitating effects of anticipating negative outcomes as opposed to positive ones have been emphasized by several authors (e.g. Geen and Gange, 1977; Weiss and Miller, 1971). Often, negative expectancies associated with subsequent poor performance are explained as effort withdrawal (as in learned helplessness theory of Carver, Blaney and Scheier, 1979). An alternative explanation for some cases is that positive expectancies counterbalance paradoxical performance effects in response to pressure, while negative expectancies do not. Two studies (Bond, 1982; Geen, 1980) have shown that when subjects had recently experienced successful performance, they did not choke in the presence of an audience; however, subjects who had recently failed did show impaired performance under the pressure of observation.

Performance under pressure may also be mediated by the *range of possibilities* for success or failure. For example, if one plays against a superior partner in a tennis tournament, the situation offers a very positive outcome if one wins or a fairly neutral outcome if one loses (as expected). Likewise, the superior partner can expect either a neutral or a very negative outcome. These expectancies can alter the perceived pressure in a situation and, hence, the likelihood of paradoxical performance effects. Thus, first year professional athletes may not feel much pressure if they are confident that they can compete but are not expected to be outstanding in their first professional season.

Another important aspect of a person's expectancies is their congruence with those of significant others. If a performer knows that the audience expects him to do well, but he is doubtful of his ability, pressure to do well may be especially severe (*cf.* Schlenker and Leary, 1982). In fact, Seta and Hassan (1980) found that the performer's prior success or failure interacted with audience awareness of prior outcomes in affecting performance. Having an audience that was aware of one's prior success impaired performance in verbal learning in comparison to having an unaware audience. Conversely, an audience that was aware of prior failure improved performance relative to the unaware condition.

Baumeister *et al.* (1985) showed that success expectancies can help or harm performance depending on who holds them. The performer's expectancy of success typically improved performance. In contrast, an audience's expectancy of success tended to produce poor performance, presumably by increasing the pressure on the performer to live up to the audience's high expectations.

Individual differences

Abundant anecdotal evidence, including prevailing beliefs among sportswriters and fans, suggests that some persons are more prone than others to choke under pressure. Indeed, some athletes seem to improve under pressure.

Past research suggests three variables which may predict individual differences in choking: anxiety, self-consciousness, and level of skill. These global differences are important because they may suggest the processes by which performance is impaired under pressure in many specific instances. While we would not expect to find choking only in anxious or self-conscious people, situational anxiety or self-consciousness may impair most athletes' performances at one time or another.

People who are anxious in test situations have been shown to be especially vulnerable to the detrimental effects of pressure variables (*cf.* Eysenck, 1979). Of course, the focus has been clearly on cognitive and intellectual performance rather than athletically relevant tasks. A huge body of literature demonstrates larger performance decrements for high test anxious subjects compared to lows in pressure situations (e.g. Deffenbacher, 1978; Doctor and Altman, 1969; Ganzer, 1968; Sarason, 1956, 1959; Spielberger and Smith, 1966). In some cases, low anxious subjects actually perform better under pressure than not, while highly anxious subjects show decrements (e.g. Nicholson, 1958; Paul and Eriksen, 1964; Sarason, 1961; Sarason and Palola, 1960; Tecce and Happ, 1964).

The importance of individual differences in anxiety for predicting sports performance is moot. It seems quite plausible that chronic performance anxiety could harm performance in individual cases. On the other hand, participation in sports is often voluntary (unlike test-taking), so there may be relatively few athletes with high levels of chronic anxiety and with resultant performance deficits; both the aversiveness of the anxiety and the consequences of failure (tournament elimination, team roster cuts) may tend to keep such people out of sports. Mere nervousness is not necessarily similar to anxiety in either its causes or its effects on performance. Moreover, there seems to be little or no experimental evidence as to whether measured differences in trait anxiety can predict differential performance on athletically relevant tasks.

The second individual difference relevant to choking is dispositional self-consciousness (*cf.* Fenigstein, Scheier and Buss, 1975). In several experiments, Baumeister (1984) found persons low in self-consciousness to be more susceptible to choking than people high in self-consciousness. He interpreted this to mean that pressure increases self-awareness, which is what disrupts performance; people who are always highly self-conscious may be accustomed to performing while self-focused, whereas the state of self-awareness may be most disruptive to persons who rarely experience it.

Because athletes may vary widely in their dispositional self-consciousness, and because several of the models of choking implicate self-focused attention, it seems a promising candidate for further study. Future research is needed to corroborate the greater tendency of low (than high) self-consciousness persons to choke, and to distinguish between the effects of public versus private self-consciousness on performance.

The third individual difference variable suggested by past research is level of skill. Paulus *et al.* (1972) found that high school student's gymnastic ability was positively correlated with performance *decrements* in the presence of an audience, although the data may be confounded by regression effects. In contrast, Baumeister (1984) reported zero correlation between initial skill and pressure-induced change in performance. Skill probably interacts with other factors in determining how much pressure is perceived in a given situation. For example, a novice athlete may not feel pressured to win his first competition; on the other hand, doing well may be more

important to him than to someone who has proved himself in previous meets. As one becomes an expert at a skill, the actual degree of impairment may be less since skills become well-learned and less variable. However, as skills become more reliable, pressure may appear to have a stronger influence on each competitive outcome.

This issue of skill level is further complicated by the related issue of certainty of self-perceived skill. Trope (1982) found, for example, that people were more motivated to perform well when they were uncertain (than certain) about their level of ability. This effect presumably occurs because the uncertainty makes the performance into an important means of establishing one's level of ability. One implication is that research on pressure should not rely exclusively on laboratory studies, for their results may not always generalize to accomplished athletes and other performers. Laboratory subjects confronted with an unfamiliar task may be motivated partly by their lack of knowledge about their own ability level on that task, but professional athletes normally can draw on extensive past experience as a reliable basis for precise self-appraisals of ability.

Clarifying the relationships between level of skill and choking (e.g. a nonmonotonic relationship with 'plateaus') might help identify athletes most in need of pre-contest psychological bolstering.

Future research may study additional variables to predict individual differences in choking. Self-esteem seems a promising one, because high self-esteem may cause self-confidence under pressure and may thus improve performance. Numerous studies have in fact shown that self-esteem can affect purely cognitive performances, especially in interaction with prior outcomes of success versus failure (e.g. Baumeister and Tice, 1985; McFarlin, Baumeister and Blascovich, 1984; Perez, 1973; Schalon, 1968; Shrauger and Sorman, 1977; Silverman, 1964) and with self-focus (Brockner, 1979). The characterization of the type A coronary-prone behaviour pattern as hard-driving and competitive (Carver, Coleman and Glass, 1976; Jenkins, Rosenman and Friedman, 1967), and as highly sensitive and resistant to developments that alter one's range of options (Rhodewalt and Davison, 1983), corroborates findings of differences in performance under pressure (Brunson & Matthews, 1981; Gastorf, Suls and Sanders, 1980).

DISCUSSION

Given the experimental evidence of choking, it is desirable to go a step further and summarize how the evidence reflects on the available theories. Still, our comments in this regard must be recognized as very tentative, for considerably more research on choking remains to be done.

As we noted above, pure drive theories seem inadequate to explain choking effects. These are descriptive, 'black box' theories that fail to explicate the actual processes by which pressure impairs performance. Moreover, the notion of drive has not been well operationalized. These problems are exemplified when one attempts to use drive theories to predict and explain individual differences in susceptibility to choking. It is easy to postulate that individuals have different baseline levels of arousal, are differentially responsive to arousing stimuli, or follow idiosyncratic inverted-U curves. Or, applying dominant response theory, one may claim that individuals have different response potential baselines and ceilings. However, these abstract models do not

explain the psychological or physiological processes underlying the curvilinear relationships, and they do little to help us predict observable differences.

Thus, it appears that choking under pressure should at present be approached as an attentional phenomenon. If drive in the sense of subjective motivation does lead to choking, it probably does so by means of attentional processes and in interaction with attentional variables.

We discussed two different (but overlapping) emphases in attentional explanations of choking: distraction and self-awareness. The research reviewed here does not clearly favour either distraction or self-awareness as the best explanation for choking. Consequently, we must at present consider the alternatives of distraction and self-awareness theories as the central controversy and most pressing theoretical issue for research on choking under pressure.

The controversy between self-awareness and distraction theories is further complicated because both may be independently correct, or they may work together. Each one seems capable of harming performance. Wine (1971) identified self-focus as the critical variable in the performance decrements caused by test anxiety, and Baumeister (1984, Experiments 1–3) demonstrated skilful performance decrements due to instructions to be aware of one's performance process. That distraction can harm performance scarcely needs evidence. Thus, distraction and self-awareness theories may each explain some instances of choking. It is also plausible that they operate together, for some self-awareness theories (e.g. Duval and Wicklund, 1972) attribute the deleterious consequences of self-awareness to distraction.

Two findings especially indicate that self-focus plays a role in choking. One is that individual differences in trait self-consciousness predict choking (Baumeister, 1984; see also Tice, Buder and Baumeister, 1985 on developmental patterns in choking based on age differences in self-consciousness). The second is the suggestion that prior outcomes of success and failure affect choking, especially if they are known to the audience (Geen, 1980; Seta and Hassan, 1980). It is not clear why an audience's awareness of prior success versus prior failure would make that audience differentially distracting—unless such awareness differentially affected the nature of a performer's self-focus by altering what he thinks the audience is thinking about him and expecting him to do. Given these two findings, which need further study, it seems safe to accord some role to self-awareness in the causal mediation of choking under pressure. The question is, are the effects of self-awareness due to distraction or to some other factor?

There are five models for how self-awareness can harm performance. Three of these involve distraction. The first is consistent with the idea that performance-contingent reward causes performers to think about the rewards (as argued by Haddad *et al.*, 1976; McGraw and McCullers, 1974; Miller and Estes, 1961). It holds that performers imagine themselves as having already won the rewards. Thus, an athlete may choke during a championship game because he was already imagining what it would be like to be celebrating the victory. The second explanation emphasizes worry; that is, the performer is distracted by (self-focused) fear of failing. For example, an athlete may choke because during the contest she is thinking about how she would explain failure to her friends. The third explanation holds that attention to self is *by definition* a distraction, because one cannot simultaneously be aware of oneself and aware of one's environment (as argued by Duval and Wicklund, 1972; Wicklund, 1979). (It deserves mention that there are process-oriented models of self-awareness that do not regard self-attention and attention to task as mutually exclusive, e.g. Hull and Levy, 1979.)

All three of the distraction/self-awareness models explain choking in terms of the failure to process information necessary for the performance. It is as if the performer is daydreaming and therefore responds too slowly or carelessly to make the play.

The last two self-awareness theories of choking do not rely on distraction. Both hold that responses may be executed either consciously or automatically, and that self-focus causes one to respond consciously. One explanation holds simply that skilful performance is best if executed automatically, that consciousness does not contain the requisite knowledge, so that the conscious attempt to control one's performance process disrupts proper execution and interferes with skilful performance (Baumeister, 1984; Kimble and Perlmuter, 1970). An alternative explanation holds that consciousness does contain the requisite knowledge to respond correctly but because of its nature consciousness also considers alternative responses, and that performance decrements derive from the additional time it takes to consider and reject nonoptimal responses (as argued by Carver and Scheier, 1981a).

As we have already said, the next step in choking research is to differentiate among the five self-awareness models, especially between the distraction and the non-distraction (performance-process) models. Development of therapeutic techniques for ameliorating choking must wait until this debate is resolved. If distraction produces choking, therapeutic intervention should emphasize reducing the athlete's distractibility, perhaps by improving concentration. Attention to task-relevant features is critical. Meditative exercises might be effective.

In contrast, if the performance-process models correctly explain choking, therapeutic approaches should emphasize reducing self-focus, such as by 'mental practice' that rehearses the appropriate attentional foci and the psychological dynamics of the impending performance. The cultivation of positive efficacy expectancies (Bandura, 1977) is also likely to be of central importance. Anticipating and working through self issues beforehand could possibly prevent them from arising during performance. The appropriate focus of attention here is narrower than that specified by distraction models. According to performance-process models, the best attentional focus is task-oriented as opposed to self-oriented. However, the task focus must be of a special kind—that is, global, not fixed on any one component of the skill, so that it will not interfere with automatic performance processes that are not consciously accessible.

Another vital issue for research is that some people may consistently and reliably perform at their best only under pressure. It is necessary to demonstrate and explain (predictively) how pressure can lead sometimes to choking and sometimes to improvements or peak performance.

Choking under pressure is a concern of many persons in sports, from athletes and coaches to team owners and the sport psychologists they employ. It is our hope that the present paper will stimulate further and systematic research on the causes of choking.

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RÉSUMÉ

Les effets paradoxaux de performance ('suffocation sous la pression') sont défianis comme l'occurrence d'une performance inferieure en dépit d'efforts et de motivations pour une performance supérieure. On passe en revue les démonstrations expérimentales de ces effets sur des tâches analogues à des performances athlétiques, ainsi que les théories qui peuvent les expliquer. Pour l'heure, ce sont les théories attentionnelles qui offrent l'explication la plus complète des processus qui sous-tendent les effets paradoxaux de performance. En particulier, la 'suffocation' peut résulter d'une distraction ou de l'interférence d'une attention auto-centrée sur l'exécution de réponses automatiques. Les découvertes expérimentales des diminutions paradoxales de performance sont associées à quatre variables de pression: présence d'une audience, compétition, récompenses et punitions contingentes à la performance, et pertinence de la tâche pour soi. On discute les facteurs médiateurs: complexité de la tâche, attentes et différences individuelles.

ZUSAMMENFASSUNG

Die paradoxen Leistungseffekt werden definiert als das Vorkommen von verminderter Leistung trotz Anstrengung und Belohnung für höhere Leistung. Die experimentellen Untersuchungen dieses Effekts bei zu athletischen Leistungen analogen Aufgaben sowie die zur Erklärung herangezogenen Theorien werden durchgesehen. Zum gegenwärtigen Zeitpunkt sind es die Erwartungstheorien, die die ausführlichsten Erklärungen der Prozesse des

paradoxen Leistungseffekts vorweisen. Im besonderen kann die Leistungsverminderung auf Unaufmerksamkeit oder auf die Interferenz von auto-zensurierter Unaufmerksamkeit auf die Ausführung von automatischen Reaktionen zurückgeführt werden. Die experimentelle Entdeckung der paradoxen Leistungsverminderung muss im Zusammenhang mit folgenden vier Drucksituationen gesehen werden: Gegenwart von Zuhörerschaft, Wettstreit, leistungsabhängige Belohnung und Bestrafung und die Eigenbedeutung der Aufgabe. Die Wichtigkeit der vermittelnden Faktoren wie Aufgabenkomplexität, Erwartungshaltung sowie individueller Unterschiede werden diskutiert.