Communication Anxiety and the Acquisition of Message-Production Skill

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There is reason to believe that the interfering, off-task thoughts that accompany anxiety may place anxious individuals at a disadvantage in the skill-acquisition process. Previous research indicates that the course of skill acquisition is characterized by the power function $P = BN^{\alpha}$. *This study sought to examine the relationship between state anxiety and three parameters defining individuals' learning curves:* α*, the learning-rate parameter; B, the* y*-intercept of the learning curve; and* r^2*, a measure of the fluctuations in performance quality from trial to trial. The results indicated that communication anxiety is associated with lower values of* α*, higher B values, and lower* r^2 *values.* **Keywords:** anxiety, cognitive interference, learning rate, power law, practice, skill

It is typically held that anxious or apprehensive individuals tend to exhibit interaction behaviors that are perceived as less skillful or appropriate than those of their non-anxious counterparts (Leary, 1983; McCroskey, 1978). And, while evidence of behavioral deficits does not emerge in every study (Clark & Arkowitz, 1975; Segrin & Kinney, 1995), a recent meta-analysis by Patterson and Ritts (1997) does indicate that communication anxiety is related to a variety of behaviors such as less fluent speech and decreased verbal and nonverbal involvement. In light of the relationship between skilled interaction behaviors and communication anxiety, skills training of one sort or another is commonly recommended as a means of relieving problems of anxiety and social withdrawal (Phillips & Sokoloff, 1979; Trower, Bryant, & Argyle, 1978; Zimbardo, 1977; see also Pelias, 1989; Williamson-Ige, 1989), and there is empirical evidence of the effectiveness of skills-training programs in addressing such problems (Allen, Hunter, & Donohue, 1989; Curran, 1977; Glaser, 1981; Kelly, 1984).

At the same time, however, there is reason to believe that anxious people may be at a comparative disadvantage in the skill-acquisition process. A number of theorists have suggested that communication anxiety is related to the propensity to experience distracting and off-task thoughts (Greene & Sparks, 1983; Sarason, Sarason, & Pierce, 1991; Schlenker & Leary, 1982; Trower, 1981). Anxious people appear to be particularly concerned with evaluation, self-presentation, and worries about personal ability (Leary, 1983; Patterson & Ritts, 1997; Pierce, Henderson, Yost, & Loffredo, 1996). Such distracting cognitions, in turn, might be expected to interfere with skill acquisition. That is, when learning a new skill, performance should be expected to suffer when a person's thoughts are focused on something other than the information requisite for executing that skill (Ericsson, Krampe, & Tesch-Romer, 1993; Kanfer & Ackerman, 1989; Kyllonen & Woltz, 1989).

It is the juxtaposition of these two lines of research (i.e., the emphasis on skills and

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skill training as a means of addressing problems of communication anxiety and the tendency toward distracting cognitions that may interfere with skill acquisition) that has prompted the investigation reported here. The focus of this study is upon the potential impact of a state of anxiety upon the course of skill acquisition. More specifically, our primary aim was to determine whether anxiety influences the parameters which define an individual's skill-learning curve.

Skill Acquisition and the Power Law of Practice

The course of skill acquisition as a function of practice is characterized by substantial improvements in performance early on, followed by diminishing performance increments as the skill continues to be executed. This regularity is expressed by what is termed the "power law of practice" (Newell & Rosenbloom, 1981) given by the equation:

$$P = \mathrm{B}N^{\alpha} \tag{1}$$

where P is some measure of task performance, B is the y-intercept of the learning curve (representing level of performance on a hypothetical "zeroth" trial), N is the number of practice trials, and α is the slope of the learning curve.

Equation 1 suggests that the value of P, the index of performance quality, will increase in magnitude over the course of practice. Of course, some measures of the quality of task performance (e.g., error rate, time) will show the opposite pattern (i.e., smaller values as practice continues). Thus, when time to complete a task is used as the measure of task performance, repeated practice trials will result in successively more rapid task execution, but again, with diminishing decrements in performance speed. With time as the index of performance, then, equivalent expression of the power law is given by the equation:

$$T = \mathrm{B}N^{-\alpha} \tag{2}$$

Evidence that the power law does, indeed, characterize the course of skill acquisition is plentiful, leading Newell and Rosenbloom (1981) to assert that this regularity "is ubiquitous over all types of mental behavior" (p. 34). Performance in such diverse skills as cigar making (Crossman, 1959), reading inverted text (Kohlers, 1975), and application of a complex set of decision rules (Woltz, 1988) has been shown to conform to a power function. More relevant to the current discussion, there is also evidence that the course of acquisition of communication skills is consistent with the power law. A recent series of studies by Greene and his associates (Greene, Sassi, Malek-Madani, & Edwards, 1997) indicates that acquisition of a new message-production skill reflects just such a pattern.

The applicability of the power law to the acquisition of communication skills suggests a means of examining the impact of anxiety on the course of skill acquisition. By deriving a skill-acquisition curve for each person, it is possible to examine relationships between the parameters that define that curve and people's level of social anxiety. More specifically, analysis of people's performance data while practicing a new skill can be used to derive three parameter estimates: B, the y-intercept for performance quality; α, the slope of the learning curve; and r^2, a measure of the variability, or fluctuations, in performance quality.

The technique for arriving at these learning-curve-parameter estimates is straightforward. A time series for each person is first collected by having each individual

complete a number of performance trials. Log transformations of the performance measure on each trial and trial number can then be used to convert the power function to its corresponding linear form. For example, expressed as a linear function, Equation 2 above becomes:

$$\log T = \log B - \alpha \log N \qquad (3)$$

Linear regression techniques can then be used on the log-transformed data to arrive at estimates of B, α, and r^2.

Communication Anxiety and Skill Acquisition

The tendency for anxiety to be associated with distracting ruminations suggests a pair of hypotheses concerning the impact of anxiety on the learning-curve-parameter estimates. First, we should expect that the concerns about evaluation, personal ability, and impression management that accompany anxiety would be reflected in more hesitant performance, particularly early in the process of skill acquisition. Thus, when performance is assessed as time to complete a message task, anxious individuals should exhibit slower, more hesitant responses, a fact which should be reflected in B, the *y*-intercept of the skill-acquisition curve:

H_1: State communication anxiety will be positively correlated with B, the *y*-intercept of the skill acquisition curve (when performance is assessed as time to complete a message task).

In a similar fashion, we should expect that people experiencing off-task thoughts will exhibit greater fluctuations in performance level from trial to trial. Thus, a comparatively proficient trial or trials may be followed by one or more trials in which interfering thoughts lead to poorer performance. The effect of such variations in performance level will be to reduce the value of r^2 for the power-curve fit. Following this line of reasoning, the following hypothesis is advanced:

H_2: State communication anxiety will be negatively correlated with r^2, an index of fluctuations in performance level.

Finally, predictions about the impact of anxiety on α, the learning-rate parameter, are less clear cut, although we might expect that distracting ruminations will be associated with slower rates of skill acquisition. In light of this possibility, we sought to explore the potential impact of anxiety on skill-acquisition rate, and the following research question was advanced:

RQ_1: Is there a relationship between state communication anxiety and α, an index of skill-acquisition rate?

Mechanisms Linking State Anxiety and Skill Acquisition: The Role of Cognitive Interference

Our hypotheses are predicated on the assumption that the interfering, off-task thoughts accompanying anxiety may result in more hesitant and erratic performance. Similarly, our research question suggests that cognitive interference may be associated with slower rates of skill acquisition. It should be clear, however, that simply to demonstrate that statistically significant relationships exist between state communication anxiety and the parameters defining the skill-acquisition curve is not a sufficient basis for concluding that cognitive interference is, indeed, the mechanism giving rise to those observed regularities. In other words, it is possible that mecha-

nisms other than distracting thoughts might underlie the link between anxiety and the course of skill acquisition. In view of this fact, our research design included an assessment of cognitive interference (see Sarason, Pierce, & Sarason, 1996) in order to determine whether any observed relationships between anxiety and performance could be attributed to distracting ruminations or whether other mechanisms might be implicated.

A Paradigm for the Study of Skill Acquisition

In order to investigate the impact of communication anxiety on skill acquisition, it was necessary to identify some experimental paradigm that would allow tracking the course of skill development over a number of practice trials. One approach to this problem, developed by Greene and his associates (Greene, et al., 1997), involves teaching participants an organizing sequence and then assessing their performance as they employ the new skill in a series of message trials. Learning such schemes for organizing message content is, of course, a common focus of training in public speaking, interviewing, and so on. In this study, participants were taught a 6-step sequence for describing simple geometric arrays. In this way it was possible to insure that they were, indeed, learning a new skill, and that, as a result, we would be observing the course of skill acquisition from its earliest stages. Moreover, the description of geometric arrays permits large numbers of message trials. Where students might give three to five speeches in the course of a typical public-speaking class, the paradigm employed here makes it possible to study skill development over dozens or even hundreds of trials.

Method

General Procedure

Data collection involved individual sessions lasting approximately 1 hour. Upon reporting to the lab, each person completed an informed consent form and a pair of individual-difference measures which were not included as part of the analyses reported here. Participants were then presented with a brief description of the study stating, in part, that:

> The purpose of this study is to assess your ability to learn a new communication skill. Previous research has shown that some people are better than others at this sort of task, and we are interested in evaluating your performance. . . . Our primary concern is with evaluating your performance . . . in order to determine how you stack up against other people.

Participants were then given a training booklet describing the organizing sequence they were to learn. They were instructed that they were free to work through this training booklet at their own pace. Once they indicated that they had familiarized themselves with the organizing sequence and were ready to proceed, the booklet was removed and they were given a 6-item state-anxiety scale adapted from the State-Trait Anxiety Inventory (Spielberger, Gorusch, & Lushene, 1970). After this, the experimenter worked through one practice trial with the participant. Each person then proceeded through a series of 45 message trials,[1] administered in blocks of 15, with a 1-minute rest period between each block. If at any point during a description the participant made an error in applying the organizing sequence (e.g., omitting a step, applying the wrong step), the experimenter immediately pointed out

the error and had the participant correct it before continuing with the remainder of the message.

During the rest periods participants read passages of material unrelated to the study. Also, during the first rest period, the 6-item state-anxiety scale was administered a second time. At the conclusion of the message trials the subject completed a shortened form of the Cognitive Interference Questionnaire (Sarason & Stoops, 1978) and was dismissed.

Participants

Seventy-nine volunteers drawn from undergraduate communication courses at Purdue University participated in this research.[2] Of this total, 12 came from a section of the basic course developed specifically to address the needs of highly communication-apprehensive individuals. Participating in this study was one means of satisfying course requirements.

Stimulus Materials

The geometric arrays used in this study were printed on 25 × 30 cm cards, with each card containing three separate arrays (see Figure 1). The three arrays on each card were arranged in positions corresponding to the 12, 4, and 8 o'clock locations on a

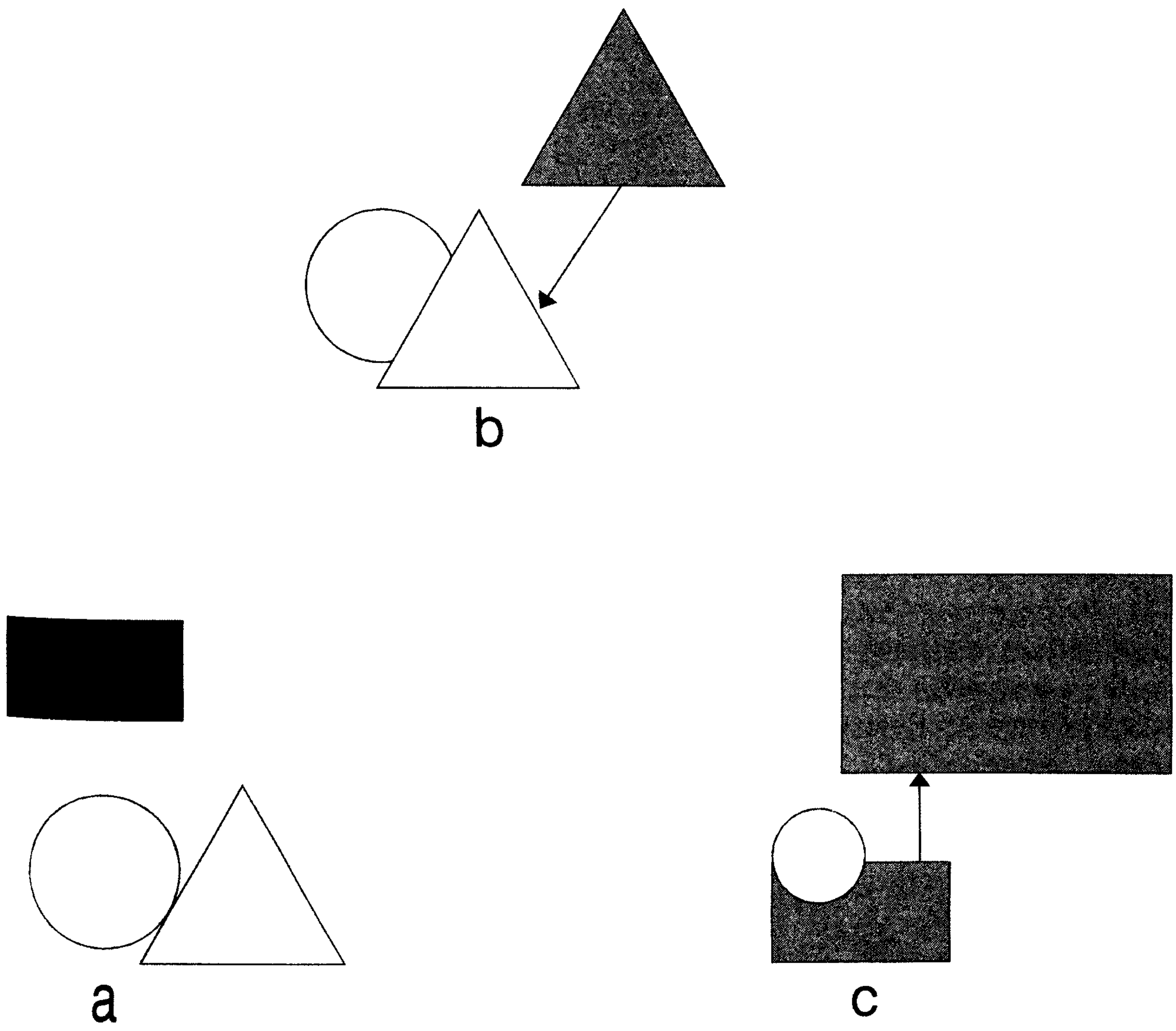

FIGURE 1.

SAMPLE STIMULUS CARD CONTAINING THREE GEOMETRIC ARRAYS.

clock face. Each array consisted of a "key figure," indicated by a lowercase "a," "b," or "c," and two other figures. One of these other figures was related spatially to the key figure (overlapping, overlapped by, or touching), and the other represented an influence relationship with the key figure, indicated by arrows (influences, influenced by, no influence). The three figures comprising each array were of three types (circle, rectangle, triangle), three sizes (small, medium, large), and three colors (white, black, gray).

The organizing sequence to be used in describing the geometric arrays consisted of the following six steps: (1) location (12, 4 or 8 o'clock), (2) type of figure (circle, rectangle, triangle), (3) size (small, medium, large), (4) color (white, black, gray), (5) spatial relationship (overlapping, overlapped by, touching), and (6) influence relationship (influences, influenced by, no influence).

On each message trial the experimenter presented the subject with a card and indicated which of the three arrays on that card he or she was to describe. The designation of figures a, b, or c was in random order, but each letter was designated for description an equal number of times over the course of each block of 15 trials. The order of the cards themselves was different for each participant. Once the participant had completed a description, he or she was presented with a new card, and the experimenter again designated an array for description. There was a lag of approximately 5 seconds between completion of a description and the instruction indicating which of the new arrays should be described. Participant responses were audio recorded for subsequent analysis.

Self-report Measures

State anxiety was assessed by use of two administrations (i.e., before and after the first block of message trials) of a 6-item scale drawn from the State-Trait Anxiety Inventory (Spielberger, Gorusch, & Lushene, 1970).[3] Cronbach's α reliabilities for the first and second administrations of this scale were .86 and .87, respectively. A composite measure constructed by combining the responses to both passes produced a scale with a mean of 26.19 and a standard deviation of 6.74; Cronbach's α for this composite measure was .90.

Cognitive interference was assessed by use of a 6-item scale drawn from the Cognitive Interference Questionnaire (Sarason & Stoops, 1978; see also Sarason, Pierce, & Sarason, 1996; Sarason, Sarason, Keefe, Hayes, & Shearin, 1986).[4] The mean and standard deviation for this sample were 16.05 and 4.99; Cronbach's α was .80.

Performance Measures

On the assumption that skilled behavior reflects rapid, or fluent, performance, time to complete each description was taken as the index of performance quality.[5] This interval was assessed as the period between the experimenter's indication of which key figure on a card was to be described and the completion of the subject's description of that figure. One person timed the descriptions of 67 participants (a total of 3,015 messages). A second person timed the descriptions of the remaining 12 participants (a total of 540 messages). In order to establish the reliability of these measurements, a third person, working independently, timed a subset of 225 messages originally timed by the first person and another set of 225 messages originally timed by the second person. This procedure produced a correlation coefficient greater than .99 for both of the original timers, indicating high reliability in assessing the description durations.

The product of this step in the data analysis was a time series of 45 observations for each participant in the study. Equation 3 was then applied to this data to arrive at values of α, B, and r^2 for each subject. With sample size equal to 79, power to detect a "medium" population r of .30 (Cohen, 1969) between state anxiety and these performance measures was .77 (α = .05, two-tailed).

Results

Hypotheses and Research Question

Hypothesis 1 was that state anxiety would lead to slower, more hesitant performance, particularly early in the course of skill acquisition, a tendency which should be reflected in a positive correlation between anxiety and B, the y-intercept of the skill-acquisition curve. This hypothesis was supported, $r = .24$, $df = 77$, $p = .034$.

Hypothesis 2 was that since state anxiety tends to be accompanied by intrusive thoughts, anxiety should be negatively correlated with r^2 values, an index of the fluctuations in message performance. This hypothesis was also supported, $r = -.28$, $df = 77$, $p = .013$.

It is important to note here that the values of α and r^2 for empirically derived learning curves tend to be contingent upon the value of B, the y-intercept of those curves (see Sassi & Greene, in press). When the value of the y-intercept of the learning curve is low, α values tend also to be low because there is relatively less room for improvement for those people who are initially very proficient in their performance. Conversely, people who are initially slow in their execution of a skill tend to have steeper learning curves (i.e., larger α values) because they have the potential for greater relative improvement. It is also the case that B tends to be positively associated with values of r^2 - this due to the fact that the power curve tends to fit performance data less well when there is relatively little improvement over the course of the performance trials. In the present case, the correlation between B and r^2 was .39; similarly, the correlation between B and α was .81. For this reason we sought to examine the correlation between state communication anxiety and r^2 after controlling for the effects of B. This partial correlation was significant, $pr = -.42$, $df = 76$, $p < .001$, indicating that after controlling for the effects of differences in B, there was a substantial relationship between state anxiety and the tendency toward more erratic performance.

Finally, Research Question 1 concerned whether there would be any relationship between state anxiety and α, the learning-rate parameter. In this case, the correlation between state anxiety and α indicated virtually no relationship between these variables, $r = .02$, $df = 77$, $p = .846$. However, once the effects of differences in B had been partialled out, a significant correlation emerged, $pr = -.30$, $df = 76$, $p = .008$, indicating that people experiencing higher levels of anxiety also had lower rates of skill acquisition.

Cognitive Interference as the Mechanism Underlying Anxiety-Performance Relationships

Having demonstrated that state communication anxiety is associated with the intercept (B) and slope (α) of the skill-acquisition curves obtained in this study and with trial-to-trial fluctuations in performance quality (r^2), it remains to ascertain whether these observed relationships may have been due to the role of distracting,

off-task ruminations. Toward this end, each of the three performance measures, B, α, and r^2, was treated by a regression analysis in which score on the cognitive-interference scale was entered as the first predictor variable, followed by the state-anxiety measure. If the observed relationships between the learning-curve parameter estimates and state anxiety are, indeed, solely the result of cognitive interference, then we should expect that cognitive interference would be a significant predictor of the performance measures and that, once the impact of cognitive interference has been accounted for, the state-anxiety measure would not pick up any additional variance in the dependent variables.

The results of the regression analysis for B indicated that cognitive interference was, indeed, a significant predictor of the intercept of the learning curve, $F = 4.56$, $df = 1, 77$, $p = .036$, $R^2 = .056$, and moreover, once the variance due to cognitive interference had been removed, state anxiety did not account for a significant increment in variance explained, $F = 1.55$, $df = 1, 76$, $p = .217$, R^2 change $= .019$. These results, then, are consistent with the notion that the positive correlation between state communication anxiety and the intercept of the skill-acquisition curve is the result of cognitive interference.

The regression analysis for r^2 produced a rather different picture. In this case, values of B were entered as the first predictor variable in the regression equation in order to control for the impact of B on r^2, $F = 14.01$, $df = 1, 77$, $p = .0003$, $R^2 = .154$. The cognitive-interference term was also significant, $F = 6.74$, $df = 1, 76$, $p = .011$, R^2 change $= .069$. However, unlike the results of the analysis of the intercept of the learning curve, the regression analysis for r^2 indicated that, over and above the impact of cognitive interference, state anxiety accounted for a significant portion of the variance, $F = 9.27$, $df = 1, 75$, $p = .003$, R^2 change $= .085$. Thus, it appears that while some of the impact of state anxiety on variations in performance quality from trial to trial may be attributed to the role of cognitive interference, some additional factor or factors is operating as well.

Like the analysis of r^2, the regression analysis for α involved first partialling out the effects of B, $F = 143.16$, $df = 1, 77$, $p < .0001$, $R^2 = .650$. In this case, cognitive interference was found to have only a marginal impact on the dependent variable, $F = 3.51$, $df = 1, 76$, $p = .065$, R^2 change $= .015$. However, state anxiety was once again shown to have a significant effect on α, above and beyond the effects attributable to cognitive interference, $F = 4.14$, $df = 1, 75$, $p = .045$, R^2 change $=$ .018. Thus, just as in the case of the analysis of r^2, it appears that some factor other than cognitive interference is responsible for the relationship between state communication anxiety and learning rate.

Discussion

This research began with the question of whether a state of anxiety might impact the course of communication-skill acquisition. Skills training is often recommended as a means of addressing problems associated with communication anxiety, but there is reason to believe that the intrusive thoughts that tend to accompany anxiety might interfere with skill acquisition by diverting attention away from skill-relevant information. The results of the current study indicate that a state of anxiety is, indeed, related to both B, the *y*-intercept of the skill-acquisition curve, and to α, the learning-rate parameter. Further, state communication anxiety was shown to be related to values of r^2 - a measure of fluctuations in performance quality from trial to

trial. To summarize these effects, highly anxious individuals were slower at the outset of the message trials, had lower rates of skill acquisition, and greater variability in performance quality.

While it appears that state communication anxiety does impact the course of skill acquisition, our findings suggest that these effects are not due solely to the effects of interfering, off-task cognitions. While the observed effects may be partially attributable to cognitive interference, the analysis of both α and r^2 suggests that some other factor or factors is acting to produce the lower learning rates and fluctuations in performance quality that accompany anxiety. It is possible to identify at least three mechanisms that might be operating to produce these effects. First, it may be that heightened arousal serves to disrupt performance of the highly anxious subjects, in a manner consistent with the familiar Yerkes-Dodson Law (see Andreassi, 1989; Humphreys & Revelle, 1984; Yerkes & Dodson, 1908). Alternatively, general behavioral inhibition may cause anxious people to perform more erratically and/or to improve more slowly. Finally, it is possible that there are aspects of cognitive interference other than those tapped by our cognitive-interference scale that operated to produce the effects observed in this study. While the cognitive-interference scale assessed rumination over one's level of ability, quality of performance, propensity to become confused, and evaluation by others, it is possible to conceive of other domains of off-task thoughts (e.g., attempts to divine some ulterior purpose of the study), that might have served to disrupt the performance of the anxious subjects. Future research, then, should explore the potential role of these mechanisms in giving rise to performance deficits in skill acquisition associated with a state of communication anxiety.

A final comment concerns the implications of the current findings for approaches to treatment of communication anxiety. As was noted at the outset, skills training is often suggested as a means of addressing problems associated with anxiety, and there is evidence of the efficacy of such training. At the same time, it is also the case that skills training alone is less effective than other treatment techniques and less effective than skill training in conjunction with other techniques (see Allen, Hunter, & Donohue, 1989). Further, it appears that when a series of multiple remedial approaches are employed, it is least effective to use skills training as the first remedial technique (Hopf & Ayres, 1992; Trower, 1981). The current study suggests that because distracting, off-task ruminations may impede skill development, it may be necessary to address problems of cognitive interference (e.g., concern with evaluation, negative outcome expectations) before implementing skills training.

Notes

[1]Greene, et al. (1997) report that it may be necessary to conduct dozens of performance trials before stable estimates of the learning-rate parameter, α, can be achieved.

[2]Five additional participants did not complete the entire experimental session. One person was not a native-English speaker and was not facile in use of basic geometric terms (e.g., "circle," "rectangle"); two others were still unable to successfully apply the organizing sequence after more than two dozen trials. Another participant coughed incessantly during the message trials. A final participant exercised her right to terminate participation before completing the entire series of 45 descriptions.

[3]The items comprising this scale were: I feel tense; I feel self-confident; I feel anxious; I feel poised and in control; I feel calm and relaxed; I feel nervous.

[4]The items comprising this scale were: I thought about how poorly I was doing; I wondered what the experimenter would think of me; I thought about how others have done on this task; I thought about my level of ability; I thought about how I would feel if I were told how I performed; I thought about how often I got confused.

[5]Because the experimenter immediately called for the correction of errors in applying the organizing sequence, time to produce each message actually indexes both errors and the rapidity with which the subject could apply the sequence.

References

Allen, M., Hunter, J.E., & Donohue, W.A. (1989). Meta-analysis of self-report data on the effectiveness of public speaking anxiety treatment techniques. *Communication Education, 38,* 54–76.

Andreassi, J. L. (1989). *Psychophysiology: Human behavior and physiological response* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum.

Clark, J. V., & Arkowitz, H. (1975). Social anxiety and self-evaluation of interpersonal performance. *Psychological Reports, 36,* 211–221.

Cohen, J. (1969). *Statistical power analysis for the behavioral sciences.* New York: Academic Press.

Crossman, E. R. F. W. (1959). A theory of the acquisition of speed-skill. *Ergonomics, 2,* 153–166.

Curran, J. P. (1977). Skills training as an approach to the treatment of heterosexual-social anxiety: A review. *Psychological Bulletin, 84,* 140–157.

Ericsson, K. A., Krampe, R. T., & Tesch-Romer, C. (1993). The role of deliberate practice in the acquisition of expert performance. *Psychological Review, 100,* 363–406.

Glaser, S. R. (1981). Oral communication apprehension and avoidance: The current status of treatment research. *Communication Education, 30,* 321–341.

Greene, J. O., Sassi, M. S., Malek-Madani, T. L., & Edwards, C. N. (1997). Adult acquisition of message-production skill. *Communication Monographs, 64,* 181–200.

Greene, J. O., & Sparks, G. G. (1983). Explication and test of a cognitive model of communication apprehension: A new look at an old construct. *Human Communication Research, 9,* 349–366.

Hopf, T., & Ayres, J. (1992). Coping with public speaking anxiety: An examination of various combinations of systematic desensitization, skills training, and visualization. *Journal of Applied Communication Research, 20,* 184–198.

Humphreys, M. S., & Revelle, W. (1984). Personality, motivation, and performance: A theory of the relationship between individual differences and information processing. *Psychological Review, 91,* 153–184.

Kanfer, R., & Ackerman, P. L. (1989). Motivation and cognitive abilities: An integrative/aptitude-treatment interaction approach to skill acquisition. *Journal of Applied Psychology, 74,* 657–690.

Kelly, L. (1984). Social skills training as a mode of treatment for social communication problems. In J. A. Daly & J. C. McCroskey (Eds.), *Avoiding communication: Shyness, reticence, and communication apprehension* (pp. 189–207). Beverly Hills, CA: Sage.

Kohlers, P. A. (1975). Memorial consequences of automatized encoding. *Journal of Experimental Psychology: Human Learning and Memory, 1,* 689–701.

Kyllonen, P. C., & Woltz, D. J. (1989). Role of cognitive factors in the acquisition of cognitive skill. In R. Kanfer, P. L. Ackerman, & R. Cudeck (Eds.), *Abilities, motivation and methodology* (pp. 239–280). Hillsdale, NJ: Lawrence Erlbaum.

Leary, M. R. (1983). *Understanding social anxiety: Social, personality, and clinical perspectives.* Beverly Hills, CA: Sage.

McCroskey, J. C. (1978). Oral communication apprehension: A summary of recent theory and research. *Human Communication Research, 4,* 78–96.

Newell, A., & Rosenbloom, P. S. (1981). Mechanisms of skill acquisition and the law of practice. In J. R. Anderson (Ed.), *Cognitive skills and their acquisition* (pp. 1–55). Hillsdale, NJ: Lawrence Erlbaum.

Patterson, M. L., & Ritts, V. (1997). Social and communicative anxiety: A review and meta-analysis. In B. R. Burleson (Ed.), *Communication yearbook 20* (pp. 263–303). Thousand Oaks, CA: Sage.

Pelias, M. H. (1989). Communication apprehension in basic public speaking texts: An examination of contemporary textbooks. *Communication Education, 38,* 41–53.

Phillips, G. M., & Sokoloff, K. A. (1979). An end to anxiety treating speech problems with rhetoritherapy. *Journal of Communication Disorders, 12,* 385–397.

Pierce, G. R., Henderson, C. A., Yost, J. H., & Loffredo, C. M. (1996). Cognitive interference and personality: Theoretical and methodological issues. In I. G. Sarason, G. R. Pierce, & B. R. Sarason (Eds.), *Cognitive interference: Theories, methods, and findings* (pp. 285–296). Mahwah, NJ: Lawrence Erlbaum.

Sarason, I. G., Pierce, G. R., & Sarason, B. R. (1996). Domains of cognitive interference. In I. G. Sarason, G. R. Pierce, & B. R. Sarason (Eds.), *Cognitive interference: Theories, methods, and findings* (pp. 139–152). Mahwah, NJ: Lawrence Erlbaum.

Sarason, I. G., Sarason, B. R., Keefe, D. E., Hayes, B. E., & Shearin, E. N. (1986). Cognitive interference: Situational determinants and traitlike characteristics. *Journal of Personality and Social Psychology, 51,* 215–226.

Sarason, I. G., Sarason, B. R., & Pierce, G. R. (1991). Anxiety, cognitive interference, and performance. In M. Booth-Butterfield (Ed.), *Communication, cognition, and anxiety* (pp. 1–18). Newbury Park, CA: Sage.

Sarason, I. G., & Stoops, R. (1978). Test anxiety and the passage of time. *Journal of Consulting and Clinical Psychology, 46,* 102–109.

Sassi, M. S., & Greene, J. O. (in press). The impact of individual differences on message-production skill acquisition. *Communication Research.*

Schlenker, B. R., & Leary, M. R. (1982). Social anxiety and self-presentation: A conceptualization and model. *Psychological Bulletin, 92,* 641–669.

Segrin, C., & Kinney, T. (1995). Social skills deficits among the socially anxious: Rejection from others and loneliness. *Motivation and Emotion, 19,* 1–24.

Spielberger, C. D., Gorusch, R. L., & Lushene, R. E. (1970). *Manual for the State-Trait Anxiety Inventory.* Palo Alto, CA: Consulting Psychologist Press.

Trower, P. (1981). Social skill disorder. In S. Duck & R. Gilmour (Eds.), *Personal relationships 3: Personal relationships in disorder* (pp. 97–110). London: Academic Press.

Trower, P., Bryant, B., & Argyle, M. (1978). *Social skills and mental health.* Pittsburgh, PA: University of Pittsburgh Press.

Williamson-Ige, D. K. (1989). Selective book analysis. *Communication Education, 38,* 81–83.

Woltz, D. J. (1988). An investigation of the role of working memory in procedural skill acquisition. *Journal of Experimental Psychology: General, 117,* 319–331.

Yerkes, R. M., & Dodson, J. D. (1908). The relation of strength of stimuli to rapidity of habit-formation. *Journal of Neurology of Psychology, 18,* 459–482.

Zimbardo, P. G. (1977). *Shyness: What it is. What to do about it.* Reading, MA: Addison-Wesley.