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## Reaction Time Crossover in Schizotypal Subjects

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REACTION TIME CROSSOVER IN SCHIZOTYPAL SUBJECTS

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A Thesis

Presented to

The Faculty of the Department of Psychology  
The College of William and Mary in Virginia

In Partial Fulfillment

Of the Requirements for the Degree of  
Master of Arts

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by

Holly B. Drewer

1990

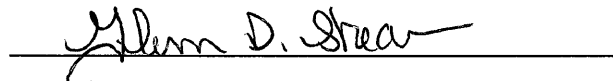
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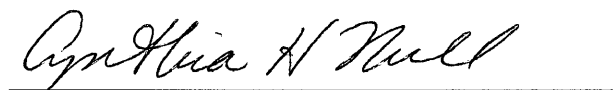
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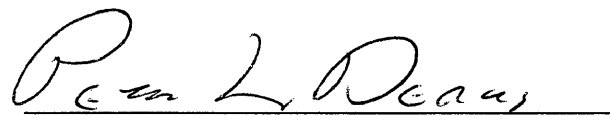
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This thesis is dedicated to Newman and Bonnie Drewer, whose love and encouragement make anything possible.

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## ABSTRACT

The present study was designed to investigate the construct validity of schizotypy as measured by the Physical Anhedonia Scale (PAS; Chapman, Chapman, & Raulin, 1976).

This study consisted of two experiments. In Experiment 1, 20 PAS-identified schizotypal college students were administered a computerized version of Rodnick and Shakow's (1940) reaction time (RT) task with an auditory distraction condition. In Experiment 2, 16 PAS-identified schizotypal subjects and 17 PAS-identified nonschizotypal subjects were administered the same RT task with a more meaningful distractor. Reaction time data were analyzed with a 2 (Group) x 2 (PI Pattern) x 2 (Distraction) x 6 (PI) analysis of variance.

In Experiment 1, the hypothesized interaction between PI duration and PI presentation was observed for the PAS-identified schizotypics in the nondistraction condition. The hypothesized crossover effect was not observed in the distraction condition. In Experiment 2, the hypothesized crossover effect for the schizotypal subjects was not observed for either the nondistraction or the distraction conditions.

Results are discussed in terms of Zubin and Spring's (1977) vulnerability theory.



REACTION TIME CROSSOVER IN SCHIZOTYPAL SUBJECTS

## Introduction

Since Meehl's proposal of an invariant personality organization (Meehl, 1962), schizotypy, the hypothesized personality trait constellation associated with a schizophrenic diathesis, Zubin and Spring (1977) have developed a trait-state vulnerability model to define individuals at risk for schizophrenia. Schizotypy, as defined by Meehl, is based on the assumption of a genetic predisposition (schizotaxia) hypothesized to be necessary, but not sufficient, for a schizophrenic episode to occur. Based on Meehl's diathesis-stress reasoning, Zubin and Spring's (1977) vulnerability model states that exogenous and/or endogenous challengers may elicit a crisis in all humans. Depending on the intensity of the elicited stress and the presence of a genetic predisposition, the authors propose that a crisis will either be contained or lead to an episode of schizophrenic disorder. Vulnerability and episode therefore stand in a trait-state relation. It is within this theoretical framework that scientists have begun to research trait markers proposed to identify individuals prone to a schizophrenic episode.

Earlier research, based on the diathesis-stress model, focused upon diagnosed schizophrenics and their offspring. Offspring of schizophrenics who are raised by their parents have been reported to be approximately ten times more likely to develop schizophrenic symptomatology than persons

randomly selected from the population (Rosenthal, 1970). Given conservative estimates of the prevalence of the disorder ranging from .2% to 1.0% (American Psychiatric Association, 1987, cited in Lowrie & Raulin, 1990), one would therefore expect that only 10% or so of these high-risk cases will eventually develop schizophrenic symptoms. This relatively low incidence rate among first degree relatives presents a considerable impediment to adequate sampling for high-risk research. In order to obtain a schizophrenic sample of a sufficient size to allow statistically meaningful inferences to be made, a large initial sample of several high-risk subjects would be necessary. These sampling problems are among those that have led investigators to develop alternative strategies.

Researchers therefore have attempted to construct self-report inventories which purport to identify characteristics of schizotypic individuals hypothetically prone to schizophrenia. These measures are based largely on attempts to measure observed constructs/traits derived from clinical literature on "pre-schizophrenic" traits. Available self-report measures include the Physical Anhedonia Scale (PAS; Chapman, Chapman, & Raulin, 1976); the Social Anhedonia Scale (Chapman, Chapman, & Raulin, 1976); the Perceptual Aberration Scale (Chapman, Chapman, & Raulin, 1978); the Magical Ideation Scale (Eckblad & Chapman, 1983); and the Rust Inventory of Schizotypal Cognitions (RISC; Rust,

1989). Each scale was developed to have high internal consistency and minimal method variance. Test-retest reliabilities indicate that measures of these traits are stable within normal populations, regardless of fluctuations in expressed symptomatology (Lowrie & Raulin, 1990).

Subjects with elevations on these schizotypy scales have been shown to display, to a greater degree than normals, impairment in functioning characteristic of schizophrenic patients (Lowrie & Raulin, 1990). Specifically, subjects with elevated scores on the Physical Anhedonia Scale produce deviant Rorschach protocols (Edell & Chapman, 1979) and appear less socially competent during behavioral tests than do controls (Haberman, Chapman, Numbers, & McFall, 1979). Also, like schizophrenic patients, these subjects have been shown to be electrodermally underresponsive in psychophysiological experiments (Simons, 1981) and to produce smaller P300 components in scalp-recorded event-related potentials (Simons, 1982).

Drewer and Shean (1989) investigated the relationship between the scales of Physical Anhedonia, Social Anhedonia, Perceptual Aberration, Magical Ideation, and Eysenck's Personality Questionnaire (1976) and reaction time (as measured by Sternberg's information-processing task). Among these measures, only the Physical Anhedonia Scale PAS was significantly correlated with delayed reaction time.

Chapman et al. (1976) developed the PAS as a measure of Meehl's construct of anhedonia. Meehl (1962) stated that there is a quasi-pathognomonic sign, anhedonia, which is a marked, widespread, and refractory defect in pleasure capacity that is one of the most consistent and dramatic behavioral signs of schizophrenia. This defect prevents development of normal healthy sexual functioning, decreased zest for life, and impairs ability to relate to others.

The trait-marker of schizophrenia proposed by Meehl's (1962) diathesis-stress model is considered to be "cognitive slippage." Meehl argues that the thought disorder of individuals diagnosed with schizophrenia is in part a function of disordered attentional processing deficits. It is within this framework that researchers have utilized the reaction time (RT) paradigm as a tool to analyze schizophrenic attentional dysfunction as a trait-marker of vulnerability.

Rodnick and Shakow (1940) first employed reaction time to preparatory intervals (PI) (the temporal interval between a warning and a stimulus) of various lengths as a quantitative measure of the ability of the schizophrenic to reach and maintain a high level of preparation in meeting recurrent environmental stimuli. The technique consisted of two procedures: the "regular" procedure in which the various PIs remained the same for a series of trials before an interval of another length was presented;

and the "irregular" procedure in which the various PIs were presented in a random order. The irregular procedure prevents any prior knowledge of the length of the PI. The regular warning procedure favors a faster reaction time, since the subject is then able to reach a higher state of preparation than would be possible with the irregular warning procedure. The difference in the reaction times of the two procedures serves as a measure of the ability of the subject to adopt an optimal set under the conditions of the regular procedure.

The results of this study clearly differentiated between the schizophrenic group and the control group: The response latencies of the schizophrenics were significantly slower than the controls. The scores of the schizophrenic group also resulted in a "crossover" of the regular and irregular performance gradients when plotted across PI duration. That is, reaction time performance under regular PIs was not just reduced to the same level but was impaired relative to the performance of the irregular PIs (Bellissimo & Steffy, 1972), indicating that schizophrenics are unable to benefit from stimulus predictability.

Shakow (1963) postulated that efficient performance on a RT task requires the maintenance of a major response set (state of readiness). Somehow, prior to the onset of the critical stimulus, schizophrenics are distracted and their major set is disrupted. Specifically, the crossover is

believed to result from the schizophrenic's undue attention to the length of the preceding PI (Zahn, Rosenthal, & Shakow, 1963).

In order to test the resiliency of the crossover phenomenon, Bellissimo and Steffy (1975) manipulated the contextual influences operating within the arrangement of trials. Neither eliminating the presence of shorter trials preceding the irregular test trials (a condition expected to dampen the effect) nor loading the series with shorter duration trials (a condition expected to increase the magnitude of the effect) substantially influenced the extent to which the long regular trials were slower than the long irregular trials (Bellissimo & Steffy, 1975). This crossover effect was found to be most characteristic of the process schizophrenic group as opposed to reactive schizophrenic, or normal control groups.

Oltmanns (1978) suggested that the effects of distraction might shed some light on the relationship between attention and schizophrenia. Oltmanns, Ohayon, and Neale (1978) found that among schizophrenics the symptom that correlated most highly with an objective index of distractibility was thought disorder. Oltmanns et al. (1978) demonstrated a differential deficit between neutral and distractor items using sets of neutral and distractor word-span tests. During the presentation of distractor lists, schizophrenics did not efficiently select relevant

items for active rehearsal. For many schizophrenics, the presence of salient extraneous stimuli appeared to disrupt the controlled processes of rote rehearsal, coding, and some forms of memory search (Oltmanns, 1978).

Lawson, McGhie, and Chapman (1967) found that while auditory span of apprehension was decreased by auditory distraction, visual span of apprehension was unaffected by the presence of visual distractors. Oltmanns and Neale (1975) and Oltmanns (1978) also demonstrated the presence of a specific susceptibility to auditory distraction on the part of schizophrenic subjects. Knight, Youard, and Wooles (1985) postulated that the apparent greater vulnerability of schizophrenic patients to distraction when processing auditory, as opposed to visual information results from the different extent to which distractors disrupt active central processing. The apparent greater vulnerability of schizophrenic patients to distraction when processing auditory, as opposed to visual information may result from differences in the extent to which distractors disrupt active central processing.

Ohman and Nordby (1986) tested the hypothesis that poor performance among schizophrenics is associated with less orienting to task-relevant stimuli and more orienting to task-irrelevant stimuli. They employed a signaled RT task in which one tone was followed by an imperative noise stimulus. During one phase of the experiment, distracting



stimuli were presented both between and during RT trials. The schizophrenics exhibited significantly slower RTs, less overall responding than the control group, and very limited differential responses to signal and nonsignal stimuli. The schizophrenic patients appeared to orient less efficiently than controls to experimental stimuli. Thus, they tended to respond less than controls to task-important events and more than controls to task-irrelevant events.

Research has strongly supported a crossover phenomenon in the schizophrenic patient within a RT paradigm. The robustness of the paradigm and the reliability of the crossover pattern across studies has prompted researchers to investigate the possibilities of RT crossover as an index-marker of vulnerability (Spring, Nuechterlein, Sugarman, & Matthyse, 1977; Steffy & Galbraith, 1980; Simons, MacMillan, & Ireland, 1982). To qualify as an index, a vulnerability indicator must be specific to the disorder, and it must not be secondary to other effects associated with the disorder. Furthermore, the indicator must be observable in individuals not currently symptomatic but known to be vulnerable (Simons et al., 1982).

DeAmicis and Cromwell (1979) investigated RT crossover in process schizophrenic patients, their relatives, and control subjects. The nondisturbed relatives exhibited RT crossover significantly greater than controls. A crossover pattern was found by Strauss, Bohannon, Kaminsky, and

Kharabi (1979) in schizophrenic outpatients.

Steffy and Galbraith (1980) evaluated the RT measures of latency and crossover in process schizophrenic patients to distinguish between state-linked and trait-linked markers. Training exercises were designed to improve the speed of RT performance. These exercises were successful in reducing latency over the course of training and from pre- to post- training assessments, with scores falling around the range of the expected performance of normal subjects. The crossover pattern did not change from the pre-assessment to the post-assessment, which indicates that this index is not a simple reflection of latency and is not responsive to training procedures involving positive motivation. Intercorrelations of the two indices showed that these measures were independent. The latency measure correlated with measures of chronicity; and the crossover pattern correlated with prognosis.

Thus far, the RT paradigm has provided consistent findings with process schizophrenics, schizophrenic outpatients, and first degree relatives of schizophrenics. Such findings suggest that the phenomena associated with a predisposition to schizophrenia lies on a continuum. If so, then the position of an individual on this continuum should be psychometrically measurable using Chapman's PAS and Shakow's RT paradigm (1940).

Simons et al. (1982) defined a hypothetically

schizotypic sample from undergraduate psychology students using Chapman's Perceptual Aberration Scale and the PAS (Chapman et al., 1976). Both groups of schizotypic subjects showed evidence of RT crossover relative to control subjects. These results are similar to those reported by Steffy and Galbraith (1980) with schizophrenic patients performing under high-incentive conditions. In both studies, mean RTs across groups were comparable, yet the RT pattern over PI variables was group-specific.

Rosenbaum, Shore, and Chapin (1988) utilized the Minnesota Multiphasic Personality Inventory (MMPI) to classify schizotypic subjects, elevation controls, and normal subjects to compare with a target group of male schizophrenics on a replication of the Rodnick and Shakow (1940) procedure. The results demonstrated that the schizophrenic patients and the schizotypic normals displayed earlier RT crossover than did the control student groups, whereas only the hospitalized schizophrenic group showed longer mean RTs. Rosenbaum et al. (1988) suggest that RT-procedure-generated measures may prove to be powerful in isolating brain mechanisms underlying attentional dysfunction.

This study was designed to investigate the construct validity of schizotypy as measured by the PAS. Subjects were selected according to their scores on the PAS. Auditory distraction was applied to Rodnick and Shakow's

(1940) RT procedure as a measure of the ability to maintain attention. As observed in other studies, an interaction between PI duration and PI regularity in the form of a crossover is expected for only the PAS-identified schizotypics. If, as suggested in previous studies, PAS-identified schizotypics exhibit a crossover phenomenon due to more orienting to task-irrelevant stimuli (distractor condition) as opposed to orienting to task-relevant stimuli, the auditory distraction should have the effect of magnifying the crossover for the PAS-identified subjects, as evidenced by an interaction between PI pattern (regular vs. irregular), PI duration, and distraction. It was also hypothesized that slower mean latencies would be observed for the PAS-identified schizotypics in the distraction condition.

The RISC, which assesses the schizotypal cognitions associated with the positive symptoms of acute schizophrenia and schizotypal personality disorder, will be administered to all subjects. Since this scale measures cognitions associated with positive symptoms, and the PAS measures cognitions more similar to the negative symptoms of schizophrenia, it is expected that these scales will be negatively correlated. It is also expected that RTs will be negatively correlated with the RISC.

## Experiment 1

### Method

#### Subjects

Students enrolled in introductory psychology classes at a small southeastern university served as subjects. Approximately 600 students, ages 18 and older, were administered an abbreviated version (25 questions) of Chapman's Physical Anhedonia Scale (1976) as part of a battery of tests given early in the fall semester. Participation was voluntary. Four hundred and sixteen protocols were returned.

Students were selected according to the criterion utilized by Chapman et al. (1976), i.e., those scoring 2 deviations above the mean were selected for the hypothetically schizotypal group, and those scoring 2 standard deviations below the mean were selected for the nonschizotypal group. The mean of the PAS scores from the fall mass testing was 4.22, with a standard deviation of 3.01.

Students were contacted by phone by the experimenter and asked to participate in a study about personality and attention. Of the 58 students who were contacted, 43 agreed to participate. Due to a computer malfunction, 3 subjects' data were discarded after they participated in the RT task component. Both the hypothetically schizotypal and the non-schizotypal group consisted of 20 subjects. Students

participating in the study received one hour of credit toward completion of a course research requirement.

### Apparatus

An IBM personal computer was used to provide a measure of simple reaction time. Rodnick and Shakow's (1940) paradigm, which tests simple RT to a visual stimulus presented following the Preparatory Intervals (PI) of 1, 2, 4, 7.5, 15, and 25 s, was employed. These PIs were presented in two sets of a fixed and random series of trials. During the first regular series, 10 trials at one PI was presented consecutively and then followed by 10 trials at another PI, in the order of 1, 25, 2, 15, 4, and 7.5 s. Trials were separated by 5-s intervals with a 60-s rest period following each 10-trial series at a given PI. During the irregular series, 12 trials of each PI were presented in a sequence in which each PI preceded every other PI at least once; and two of the same PIs were never presented in succession. This procedure was repeated employing an auditory distractor which sounded between the visual preparation signal and the visual stimulus. A 5-s intertrial interval was also provided in the irregular procedure, and a 3-min rest period followed the administration of 36, 72, and 108 irregular procedure trials.

Reaction time was measured by the computer to the millisecond. Subjects' identification number and RTs of the

regular and irregular trials were recorded on a data disk.

The auditory distractor was programmed using a Casio HX900 synthesizer with instrument timbre set at "typhoon." The distractor was delivered binaurally to the subjects through headphones connected to the synthesizer.

#### Personality Measures

Physical Anhedonia Scale (Chapman et al., 1976).

Originally a 62 - item true/false questionnaire, the current study utilized only the 25 items that were most highly correlated with an overall rating of anhedonia (Appendix A). The PAS is designed to assess physical anhedonia, as defined by a marked decrease in pleasure capacity.

Rust Inventory of Schizotypal Cognitions (Rust, 1989).

A 26 - item questionnaire, each symptom-related item is followed by four response options which indicate an individual's level of endorsement of each statement. The RISC is designed to assess the schizotypal cognitions associated with the positive symptoms of acute schizophrenia. It differs from previous scales in having been developed and standardized with special attention to normal distribution in the general population, and in emphasizing cognitive content rather than cognitive deficit.

#### Manipulation check

During the debriefing session, the first 6 subjects reported that the distractor was not "distracting" and was similar to "background music used while studying."

Therefore the following 15 subjects were asked to rate, on a scale from 1 (least distracting) to 10 (most distracting), how distracting they found the distractor (Appendix B).

### Procedure

Once subjects were chosen (as outlined above), each was contacted by telephone. All subjects were informed that they would be asked to complete two questionnaires and participate in a RT task requiring them to press the designated key when a visual stimulus appeared on the computer screen. Both written and verbal informed consents (Appendix D) were obtained from all subjects who participated in the study.

The information-processing task, the PAS, and the RISC were administered to subjects individually. Order of presentation was the same for all subjects. Subjects were asked to first complete the information-processing task. The subjects were then asked to complete the RISC and the PAS (as a measure of test-retest reliability). They were then debriefed using non-threatening terminology and everyday language and notified that the results of the study would be posted at the beginning of May. The procedure took approximately one hour per subject.

### Results

The mean of the PAS scores was 5.50, with a standard deviation of 5.10. A Pearson product moment correlation yielded a test-retest reliability of  $r(40) = .95, p < .01$ .



A Pearson product moment correlation was conducted between the mass testing scores on the Beck Depression Inventory (BDI) and the PAS to ascertain whether the BDI and the PAS (measuring depression and a pleasure deficit, respectively) were sampling the same population. The scales do not appear to be sampling the same population, or similar constructs,  $r(280) = .04$ ,  $p > .05$ . It should be noted that the BDI was only administered to female students.

#### Reaction Time Data

The reaction time data were analyzed with a 2 (Type) x 2 (Pattern) x 2 (Distraction) x 6 (PI) analysis of variance (ANOVA) to evaluate the effects of the four independent variables on response latency, with distraction, PI, and pattern serving as repeated measures.

The hypothesized crossover effect was observed with a significant three-way (Type x PI x Pattern) interaction,  $F(5,34) = 4.20$ ,  $p < .004$ . For ease of interpretation, Figure 1 shows this interaction as 2 two-way (PI x Pattern) interactions, one for each type.

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 Insert Figure 1 about here  
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Further analysis shows that there was a type by PI interaction which approached significance,  $F(5,34) = 2.25$ ,  $p > .06$ . There were significant differences between type at the 1s PI,  $t(1,38) = 4.76$ ,  $p < .04$ , and the 15s PI,  $t(1,38) =$

5.12,  $p < .038$ . Although pattern of presentation did not vary according to type,  $F(1,38) = .12$ ,  $p > .05$ , Table 1 indicates that the pattern was in the hypothesized direction: The schizotypics' mean latencies were slower for the regular pattern than for the irregular pattern.

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Insert Table 1 about here

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When individual scores were graphed, 12 out of 20 schizotypic subjects (60%) and 2 out of 20 nonschizotypics (10%) exhibited a crossover effect. A chi-square analysis of these data was significant,  $X(1, N = 40) = 10.98$ ,  $p < .001$ , supporting the crossover effect observed for the schizotypic subjects.

The distractor magnified the crossover effect with a significant Pattern x PI x Distraction interaction,  $F(5,34) = 5.66$ ,  $p < .003$ , but did not vary with group membership as hypothesized by a four-way (Type x Pattern x PI x Distraction) interaction,  $F(5,34) = 1.75$ ,  $p < .05$ . Again, although the interaction was not significant, the pattern of results was in the hypothesized direction.

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Insert Figure 2 about here

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Although a significant main effect was found for the distraction condition,  $F(1,38) = 6.84$ ,  $p < .013$ , of greater

interest was the two-way (Type x Distraction) interaction which reached statistical significance,  $F(1,38) = 3.96$ ,  $p < .05$ . The distractor differentially affected the schizotypic and nonschizotypic subjects with the schizotypics showing greater susceptibility to the distraction. A  $t$  test between ratings of reported distraction and type yielded statistically significant differences: The schizotypics' mean rating (.8) was less than that of the normals (2.90),  $t(1,36) = 5.83$ ,  $p < .05$ . The reaction times of the subjects appear to mirror their subjective ratings of the distractibility of the distractor.

#### Personality Measures

The mean of the RISC was 38.52, with a standard deviation of 9.14. A Pearson product-moment correlation did not reveal a significant relationship between the RISC and the PAS,  $r(40) = -.24$ ,  $p > .05$ . As can be seen from Table 2, the point-biserial correlations between the RISC and the reaction time data did not yield a significant relationship.

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 Insert Table 2 about here  
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#### Discussion

The results of Experiment 1 replicate previous findings on the crossover effect of hypothetically schizotypic subjects. The schizotypic subjects in this experiment, like

those in previous studies (Rosenbaum, Shore & Chapin, 1988; Simons, MacMillan, & Ireland, 1982), were found to exhibit an earlier RT crossover than control subjects. The crossover effect is similar to that found in schizophrenic subjects (Rodnick & Shakow, 1940) and has been found to be unaffected by medication (Cromwell et al., 1979) or motivational manipulations (Steffy & Galbraith, 1980).

The early crossover effect for the schizotypics appears attributable to the fact that schizotypal subjects cross over earlier (at 1s PI vs 15s PI) than nonschizotypal subjects. Although the interaction between type and pattern was not significant, it was in the hypothesized direction: The schizotypics' RT latencies to predictable PIs became slower than their RT latencies to unpredictable PIs as the interval increased.

The inability of the schizotypics to take advantage of the predictability of the fixed pattern at longer PIs suggests a deficit in maintaining conscious capacity-loading attention compared to the nonschizotypics. According to Posner (1982), it is under conditions of stimulus predictability that conscious attention should benefit performance by facilitating rapid processing of the expected stimulus. The schizotypics' inability to profit from predictability does not fully account for the phenomenon of the crossover effect, because the crossover phenomenon involves not just equal RT, but actually slower RT under

predictable, as compared to unpredictable, long PIs.

Therefore, based on Shakow's (1961) hypothesis that schizophrenic attentional deficit is, in part, a function of orienting to distracting, irrelevant stimuli, as opposed to the task-relevant stimuli, it was hypothesized that a distractor would magnify the effect of the schizotypics' crossover. Although the crossover in the distraction condition was not significant for group, the results were in the hypothesized direction: The schizotypes initially failed to take advantage of the fixed PI.

The mean subject ratings of the distraction, as well as verbalizations during the debriefing that the distraction was not "distracting," indicate that the distraction may have not had an adequate loading to elicit a differential crossover effect for group membership. As Nuechterlein and Dawson (1986) noted in a review of the literature on information processing across the schizophrenic continuum, higher processing loadings are required to tap attentional dysfunction in asymptomatic individuals identified as vulnerable to a schizophrenic episode.

The distraction affected both schizotypal and nonschizotypal subjects in that both groups evidenced delayed latencies. Although not significant, the schizotypal subjects' latencies were slower in the distraction condition than the nondistraction condition.

The RISC was included to assess the divergent

validity of the PAS. Although there was not a significant relationship, the relationship between the scales was in the hypothesized negative direction. The negative correlation is consistent with the notion that the RISC and the PAS may measure behavioral signs that are independent. The RISC was designed to assess cognitive content, which is supported by the lack of relationship with the reaction time data. Since both scales were designed to assess the same underlying construct, proneness to a schizophrenic episode, but measure independent behavioral signs, the scales may serve a useful discriminating function when employed together.

## Experiment 2

Experiment 2 was designed to address the issue that the distraction in Experiment 1 may not have had an adequate loading to elicit the crossover effect. The procedure employed in Experiment 2 was almost identical to that of Experiment 1, with the exception that the distraction employed consisted of a story read by a male's voice. It was hypothesized that, as in Experiment 1, a three-way interaction (Type x PI x Pattern) would yield a crossover effect. As an extension of this finding, it was hypothesized that the distractor, as a more meaningful stimuli requiring more complex processing, would maximize the crossover effect through a four-way (Type x PI x Pattern x Distraction) interaction in the distraction condition.

### Method

#### Subjects

Approximately 280 students (ages 18 and older) completed the abbreviated version of the PAS. Subject selection differed from Experiment 1 in that students who scored 1 to 1 1/2 standard deviations above and below the mean (as opposed to 2 standard deviations) were eligible for the study. The Experimenters could not adhere to Chapman et al.'s (1976) criterion in this study due to the unavailability of subjects. The mean of the PAS scores from the spring mass testing was 4.54, with a standard deviation of 3.12. The scores were comparable to the fall mass

testing.

Students were contacted by phone by this experimenter and asked to participate in a study about personality and attention. Of the 70 students who were contacted, 40 agreed to participate in the study. Due to a disk error resulting in failure to record data, 6 subjects' data were not usable, leaving 16 subjects in the hypothetically schizotypal group and 17 subjects in the non-schizotypal group. Students participating in the study received one hour of credit toward completion of a course research requirement.

#### Apparatus

An IBM computer programmed with Rodnick and Shakow's RT paradigm was employed as in Experiment 1, with the exception of the programming of the auditory distractor.

The auditory distractor was a story by O. Henry, read by a male's voice, delivered binaurally through earphones that were attached to a Sony tape recorder. The Experimenter turned on the tape recorder to which the subject's earphones were attached after one set of regular and irregular series of trials. The RT program then proceeded as in Experiment 1 with the story as the auditory distractor during the second set of regular and irregular series of trials.

#### Personality measurements

The personality measurements used were identical to those in Experiment 1.



### Procedure

The design and procedure were identical to those of Experiment 1, except that after one set of regular and irregular series of trials, the subject was instructed to refer to the Experimenter. The Experimenter then turned on the tape recorder and the program proceeded as in Experiment 1.

### Results

The mean of the PAS scores was 3.57, with a standard deviation of 3.60. These mean scores are lower than the scores in Experiment 1. A Pearson product moment correlation yielded a test-retest reliability of  $r(33) = .89$ ,  $p < .01$ .

A Pearson product moment correlation was conducted between mass testing scores on the BDI and the PAS to ascertain whether the BDI and the PAS were sampling the same population. There was no significant relationship,  $r(125) = .002$ ,  $p > .05$ . It is significant to note that the BDI was only administered to female students.

### Reaction Time Data

As in Experiment 1, the reaction time data were analyzed with a 2 (Type) x 2 (Pattern) x 2 (Distraction) x 6 (PI) analysis of variance (ANOVA) to evaluate the effects of the four independent variables on response latency, with distraction, preparatory interval, and pattern serving as repeated measures.

As in Experiment 1, in general, reaction times were slower when the PI was irregular than they were under regular PI conditions,  $F(1,31) = 7.22, p < .01$ . There was not a significant crossover effect, as the Pattern x PI interaction did not reach significance,  $F(5,27) = 1.31, p > .05$ . The predicted three-way (Type x Preparatory Interval x Pattern) interaction was not obtained as in Experiment 1,  $F(5,27) = 1.32, p > .28$ .

The distractor was changed from a non-meaningful distractor to a meaningful story in order to elicit the hypothesized crossover effect for the schizotypal subjects (Type x Pattern x PI x Distraction). As might be expected, since the general crossover effect (Pattern x PI) was not obtained, the four-way (Type x Pattern x PI x Distraction) interaction did not reach statistical significance,  $F(5,27) = .74, p > .05$ . Essentially there was not a crossover effect for the distractor to magnify.

A two-way (Type x Distraction) interaction reached statistical significance,  $F(1,31) = 6.26, p < .02$ . Again, the distraction had a significantly differential effect on the schizotypic subjects than the nonschizotypic subjects. Interestingly, Table 2 shows that the schizotypic subjects' mean latencies were faster in the distraction condition than in the nondistraction condition, with the nonschizotypic subjects exhibiting the reversed effect.

Although the mean ratings of reported distraction

were higher than those in Experiment 1 (2.90 vs. 3.47 for schizotypics; .8 vs. 4.50 for normals), a  $t$  test between ratings of reported distraction and type did not yield statistically significant differences: The schizotypics' mean rating (3.47) was similar to that of the normals' (4.50),  $t(1,31) = 1.56, p > .13$ .

An analysis of variance was conducted on the reaction time data as a function of task. No significant differences were found for either pattern, PI, or distraction.

#### Personality Measures

A Pearson product moment correlation did not reveal a significant relationship between the RISC and the PAS,  $r(33) = -.17, p > .05$ . Point biserial correlations between the RISC and the reaction time data are presented in Table 3. Correlations between the RISC scores and RT were nonsignificant.

#### Discussion

The crossover effect evidenced by the schizotypic subjects in Experiment 1 was not present in Experiment 2. It is suspected that the sample may have contained false positives due to the change in criterion from 2 standard deviations above the mean to 1 1/2 standard deviations above the mean. The mean of the PAS scores were lower in this experiment than Experiment 1. As Raulin and Lowrie note (1990), the method of selecting samples of high-risk cases can directly influence results, and therefore the

conclusions that can be drawn from behavioral high-risk studies.

As would be expected, since the triple (Type x PI x Pattern) interaction was not replicated, there was no evidence of the distractor magnifying a crossover effect within the schizotypal condition. The mean subject ratings of reported distraction (1.9 and 3.98 on a scale from 1 to 10) suggests that the distraction may not have had an adequate loading to elicit the hypothesized attentional deficit in asymptomatic college students.

Interestingly, the distractor had a differential effect on the schizotypal and nonschizotypal subjects. The schizotypal subjects' mean latencies were faster in the distraction condition than the nondistracted condition, whereas the nonschizotypals' mean latencies were faster in the nondistracted condition than the distraction condition. It is difficult to explain this finding other than to speculate on the presence of false positives in the sample.

As in Experiment 1, correlations between the PAS and the RISC were not significant, indicating that the PAS and the RISC measure different constructs. As shown in Table 3, the correlations between the RISC and RT scores are comparable to those in Experiment 1.

### General Discussion

The present study was designed to investigate whether subjects identified on the basis of high scores on the PAS would evidence a reaction-time crossover under conditions known to reliably elicit this pattern from schizophrenic patients. Based on Shakow's (1961) theory, the present study also employed a distractor designed to magnify the RT crossover effect. The hypothesized relationship between pattern and PI for schizotypics and normals was supported in Experiment 1, but these results were not supported or extended in Experiment 2.

The results of Experiment 1 supported the crossover effect, indicating that deficits may be related to a reduction in the processing capacity that is available for task-relevant cognitive operations in individuals identified as vulnerable to a schizophrenic episode by the PAS. Such results demonstrating the RT crossover among asymptomatic adults are consistent with the use of RT crossover as a vulnerability marker (Zubin & Spring, 1978) independent of clinical symptoms.

Based on Shakow's theory, a distraction employed with the RT paradigm was expected to extend these results by magnifying the crossover effect, thereby supporting the theory that individuals identified as vulnerable orient more to task-irrelevant stimuli, as evidenced by slower latencies in the fixed PIs. The results were in the hypothesized

direction, but not statistically significant. It was suspected that the distraction may not have had an adequate loading.

Therefore the focus of Experiment 2 was to employ a distractor with a higher processing load. The findings of Experiment 2 did not support the crossover effect in either the nondistractor or the distraction condition. The absence of the crossover effect may be due to subject selection procedures.

Another alternative to the absence of the crossover effect in the distraction condition may be due to the type of processing the distraction required. Information processing may be roughly divided into active (controlled) and passive (automatic) operations (Schneider & Shiffrin, 1977). Active processes, such as rote rehearsal, coding, and some forms of memory search, must be carried out in a serial fashion and are limited in capacity. It has been observed that for many schizophrenics, the presence of salient, extraneous stimuli disrupts these controlled processes (Oltmanns, 1978).

Passive operations may not be so vulnerable to extraneous stimuli. The deterioration in active processing of relevant material may not be due to orienting to task-irrelevant stimuli, as hypothesized by Shalowsky (1961), but to less efficient handling of relevant stimuli. This study utilized distractors that tapped passive processes as

opposed to active processes, which may not be as vulnerable to irrelevant stimuli.

If attentional dysfunction is in fact a result of interference of active processes by extraneous stimuli, what can be said of the RT crossover which is purported to tap the passive processes of sustained attention? Is the RT crossover an artifact of planned variance? Further research is needed to investigate these questions.

Evidence of the crossover effect among schizotypic subjects is not conclusive. There are several reasons, however, why this should not be construed as evidence against the hypothesized high-risk status of PAS-identified subjects. First the initial crossover effect was obtained. Second, the schizotypal crossover pattern in the distraction condition was in the hypothesized direction. Third the data in the distraction condition did suggest that absolute RTs obtained from the schizotypics were slower. While this difference was not statistically significant, it was consistent with previously reported differences (Simons et al., 1982; Rosenbaum et al., 1988). Finally, data obtained from other studies of schizotypal subjects support the high-risk hypothesis (Edell & Chapman, 1979; Simons, MacMillan, & Ireland, 1982; Rosenbaum, Shore, & Chapin, 1988).

In summary, the present reaction-time data do provide some additional validation for the Physical Anhedonia Scale

as a measure of RT crossover. In addition, some interesting questions are raised as to what subsystem of attention the RT paradigm is tapping. More research is needed employing Rodnick and Shakow's (1940) paradigm with manipulation of distraction conditions that require active processing.

While the ultimate test of the vulnerability hypothesis rests in longitudinal study, relevant evidence is cumulative and often indirect. It is true of clinical schizophrenia that no single subject characteristic assures group membership, and this is no less true of these subjects. The RT crossover is consistent with a high-risk hypothesis and provides clear evidence that PAS-identified schizotypics merit further investigation.



## References

- Bellissimo, A., & Steffy, R. A. (1972). Redundancy-associated deficit in schizophrenic reaction time performance. Journal of Abnormal Psychology, 80, 299-307.
- Bellissimo, A., & Steffy, R. A. (1975). Contextual influences on crossover in the reaction time performance of schizophrenics. Journal of Abnormal Psychology, 84, 210-220.
- Chapman, L. J., Chapman, J. P., & Raulin, M. L. (1976). Scales for physical and social anhedonia. Journal of Abnormal Psychology, 85, 374-382.
- Chapman, L. J., Chapman, J. P., & Raulin, M. L. (1978). Body-image aberration in schizophrenia. Journal of Abnormal Psychology, 87, 399-407.
- DeAmicis L. A., & Cromwell, R. L. (1979). Reaction time cross-over in process schizophrenic patients, their relatives, and control subjects. Journal of Nervous and Mental Disease, 167, 593-600.
- Drewer, H. B., & Shean, G. D. (1990, April). Relationship between self-report measures of schizotypy and cognitive performance. Poster presented at the Southwestern Psychological Association, Dallas, TX.
- Eckblad, M., & Chapman, L. J. (1983). Magical ideation as an indicator of schizotypy. Journal of Consulting and Clinical Psychology, 51, 215-225.
- Edell, W. S., & Chapman, L. J. (1978). Anhedonia,

- perceptual aberration, and the Rorschach. Journal of Consulting and Clinical Psychology, 47, 377-384.
- Haberman, M. C., Chapman, L. J., Numbers, J. S., & McFall, R. M. (1979). Relation of social competence to scores on two scales of psychosis proneness. Journal of Abnormal Psychology, 88, 675-677.
- Knight, R. G., Youard, P. J., & Wooles, I. M. (1985). Visual information-processing deficits in chronic schizophrenic subjects using tasks matched for discriminating power. Journal of Abnormal Psychology, 94, 454-459.
- Lawson, J. S., McGhie, A., & Chapman, J. (1967). Distractibility in schizophrenia and organic cerebral disease. British Journal of Psychiatry, 113, 527-535.
- Lowrie, G. S., & Raulin, M. L. (1990, April). Search for schizotypic and nonschizotypic taxonomies in a college population. Paper presented at the meeting of the Eastern Psychological Association, Philadelphia, PA.
- Meehl, P. E. (1962). Schizotaxia, schizotypy, schizophrenia. American Psychologist, 17, 827-838.
- Ohman, A., & Nordby, H. (1986). Orienting and schizophrenia: Stimulus significance, attention, and distraction in a signaled reaction time task. Journal of Abnormal Psychology, 95, 326-334.
- Oltmanns, T. F. (1978). Selective attention in schizophrenic and manic psychosis: The effect of

- distraction on information processing. Journal of Abnormal Psychology, 87, 212-225.
- Oltmanns, T. F., Ohayon, J., & Neale, J. M. (1978). The effect of anti-psychotic medication and diagnostic criteria on distractibility in schizophrenia. Journal of Psychiatric Research, 14, 81-91.
- Posner, M. I. (1982). Cumulative development of attentional theory. American Psychologist, 37, 168-179.
- Rodnick, E. H., & Shakow, D. (1940). Set in the schizophrenic as measured by a composite reaction time index. American Journal of Psychiatry, 97, 214-225.
- Rosenbaum, G., Shore, D. L., & Chapin, K. (1988). Attention deficit in schizophrenia and schizotypy: Marker versus symptom variables. Journal of Abnormal Psychology, 97, 41-47.
- Rust, J. (1989). The handbook of Rust Inventory of Schizotypal Cognitions. London: Harcourt Brace Jovanovich.
- Shakow, D. (1961). Segmental set: A theory of the formal psychological deficit in schizophrenia. Archives of General Psychiatry, 6, 17-31.
- Schneider, W., & Shiffrin, R. M. (1977). Controlled and automatic human information processing: I. Detection, search, and attention. Psychological Review, 81, 1-66.
- Simons, R. F. (1981). Electrodermal and cardiac orienting in psychometrically defined high risk subjects.

- Psychiatry Research, 4, 347-356.
- Simons, R. F. (1982). Physical anhedonia and future psychopathology: A possible electrocortical continuity. Psychophysiology, 19, 433-441.
- Simons, R. F., MacMillan, F. W. III, & Ireland, F. B. (1982). Reaction-time crossover in preselected schizotypic subjects. Journal of Abnormal Psychology, 91, 214-225.
- Spring, B., Nuechterlein, K. H., Sugarman, J., & Matthyse, S. (1977). The "new look" in studies of schizophrenic attention and information processing. Schizophrenia Bulletin, 3, 470-481.
- Steffy, R. A., & Galbraith, K. J. (1980). Relation between latency and redundancy-associated deficit in schizophrenic reaction time performance. Journal of Abnormal Psychology, 89, 419-427.
- Strauss, M. E., Bohannon, W. E., Kaminsky, M. J., & Kharabi, F. (1979). Simple reaction time crossover occurs in schizophrenic outpatients. Schizophrenia Bulletin, 5, 612-614.
- Zahn, T. P., Rosenthal, D., & Shakow, D. (1963). Effects of irregular preparatory intervals on reaction time in schizophrenia. Journal of Abnormal and Social Psychology, 67, 44-52.
- Zubin, J., & Spring, B. (1977). Vulnerability: A new view of schizophrenia. Journal of Abnormal Psychology, 86,

103-126.

Table 1

Mean Reaction Time Scores as a Function of Type,  
Distraction, and Pattern for Experiment 1

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	Condition	
Type	Distraction	Nondistraction
Schizotypal	478.41	449.16
Irregular	497.44	415.02
Regular	459.37	482.61
Nonschizotypal	446.07	426.62
Irregular	424.52	428.72
Regular	439.83	424.52

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Table 2

Mean Reaction Time Scores as a Function of Type,  
Distraction, and Pattern for Experiment 2

Type	Condition	
	Distraction	Nondistraction
Schizotypal	417.05	455.57
Irregular	428.60	381.35
Regular	405.49	429.79
Nonschizotypal	433.38	383.39
Irregular	464.56	409.70
Regular	402.21	357.09

Table 3

Point Biserial Correlations between Reaction Time  
Scores and the RISC for Experiments 1 and 2

Condition	Experiment	
	1	2
Distraction		
Regular	.03	.28
Irregular	.29	.21
Nondistraction		
Regular	.16	.28
Irregular	.29	.24



Figure 1. Reaction time performance as a function of Pattern and Preparatory Interval (PI) for schizotypal and nonschizotypal subjects in the nondistracted condition.

# Reaction Times for Fixed and Random Patterns

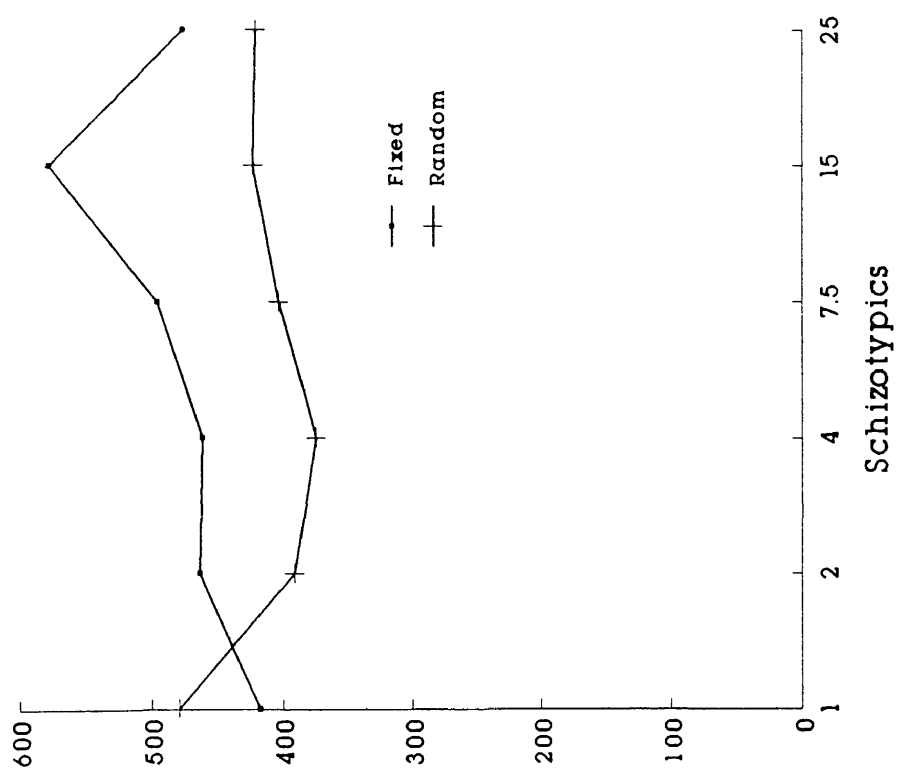
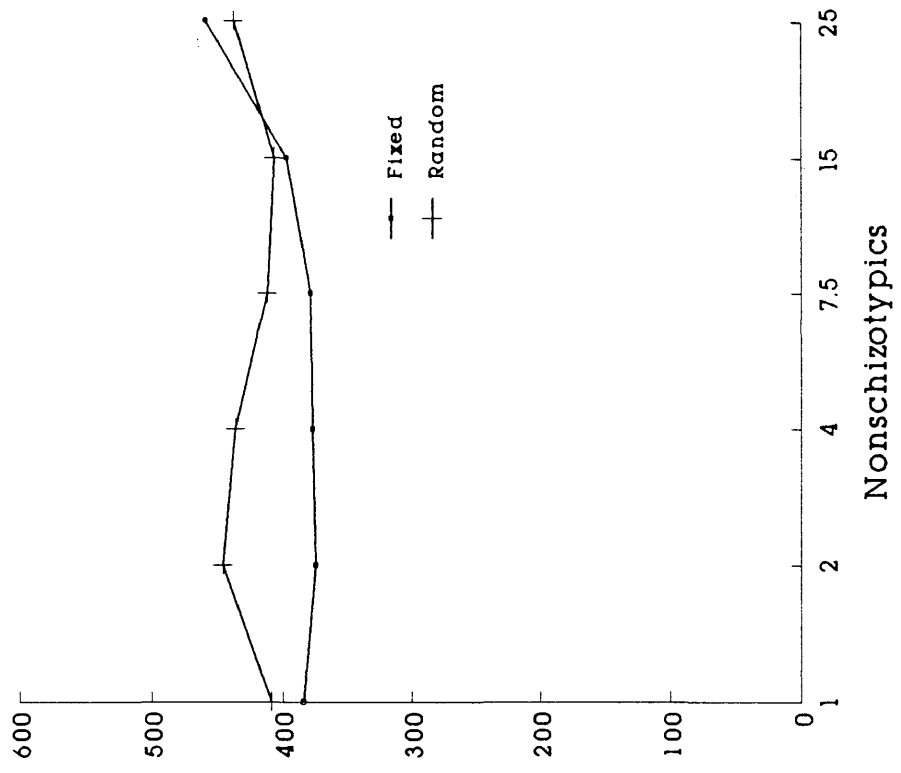
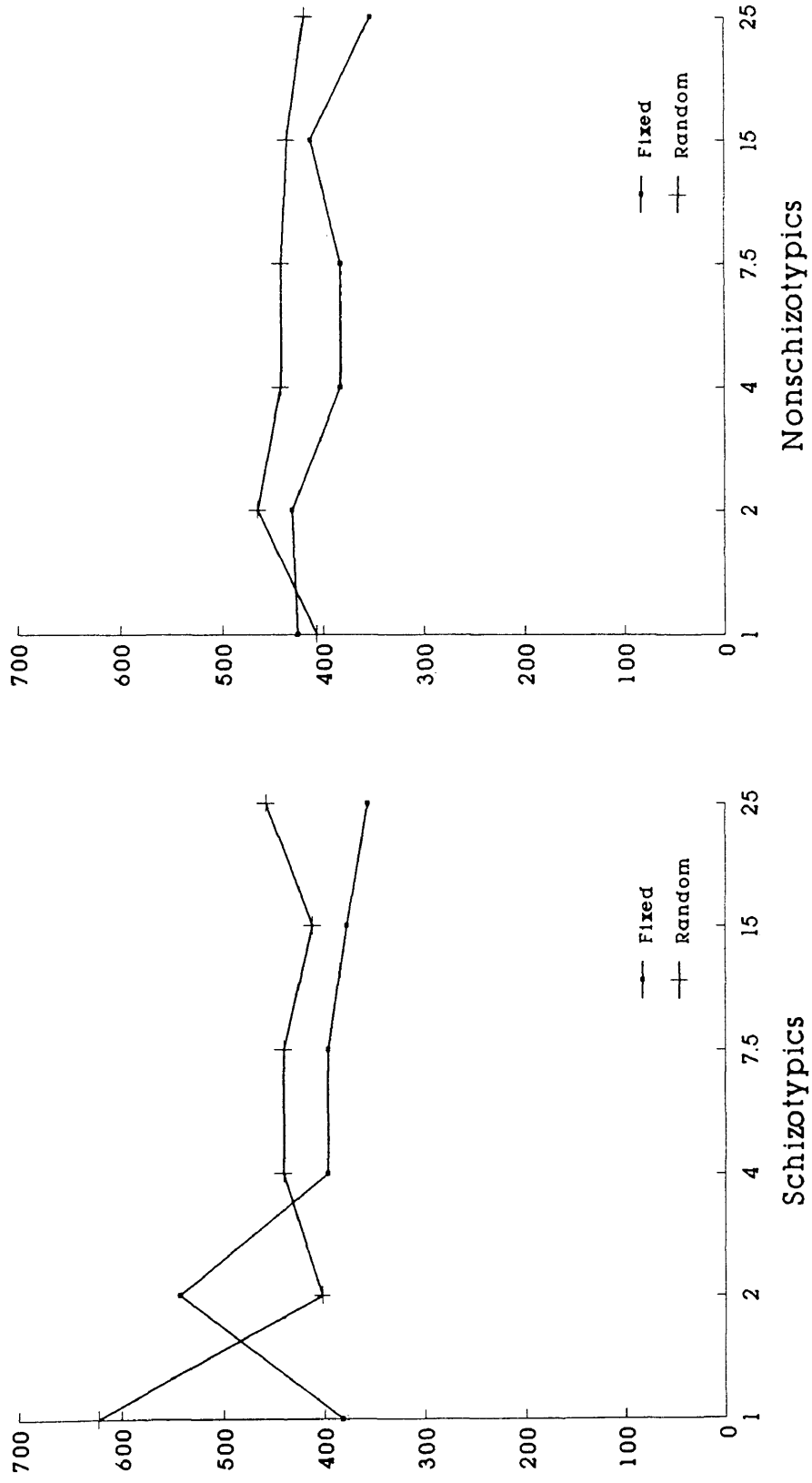


Figure 2. Reaction time performance as a function of Pattern and Preparatory Interval for schizotypics and nonschizotypics in distraction condition.

# Reaction Times for Distracting Stimuli



## Appendix A

## Chapman Scale

- |   |   |   |
|---|---|---|
| 1. When I'm feeling a little sad, singing has often Made me feel happier.                 | T | F |
| 2. Dancing, or the idea of it, has always seemed dull to me.                              | T | F |
| 3. When eating a favorite food, I have often tried to eat slowly to make it last longer.  | T | F |
| 4. I have always found organ music dull and unexciting.                                   | T | F |
| 5. I have often enjoyed the feel of silk, velvet, or fur.                                 | T | F |
| 6. I have had very little fun from physical activities like walking, swimming, or sports. | T | F |
| 7. I have sometimes enjoyed feeling the strength in my muscles.                           | T | F |
| 8. I have seldom enjoyed any kind of sexual experience.                                   | T | F |
| 9. I have always loved having my back massaged.   | T | F |
| 10. On hearing a good song, I have seldom wanted to sing along with it.                   | T | F |
| 11. Trying new foods is something I have always enjoyed.                                  | T | F |
| 12. I have always hated the feeling of exhaustion that comes from vigorous activity.      | T | F |
| 13. When I have seen a statue, I have had the urge to feel it.                            | T | F |

- |  |   |   |
|--|---|---|
| 14. The color that things<br>are painted has seldom mattered<br>to me.                       | T | F |
| 15. I have always had a number<br>of favorite foods.   | T | F |
| 16. The sound of rustling leaves<br>has never much pleased me.                               | T | F |
| 17. When I have walked by a bakery,<br>the smell of fresh<br>bread has often made me hungry. | T | F |
| 18. Sunbathing isn't really more<br>fun than lying down indoors.                             | T | F |
| 19. I have often enjoyed<br>receiving a strong, warm<br>handshake.                           | T | F |
| 20. There just are not many things<br>that I have ever really<br>enjoyed doing.              | T | F |
| 21. I have often found walks to<br>be relaxing and enjoyable.                                | T | F |
| 22. I have never found a<br>thunderstorm exhilarating.                                       | T | F |
| 23. The sound of the rain falling<br>on the roof has made me feel<br>snug and secure.        | T | F |
| 24. Sex is okay, but not as much<br>fun as most people claim it is.                          | T | F |
| 25. I like playing and petting<br>soft little kittens<br>or puppies.                         | T | F |



"Bank doesn't open 'til nine," he remarked, curtly, but without feeling. He had had to make that statement so often to early birds since San Rosario adopted city banking hours.

"I am well aware of that," said the other man, in cool, brittle tones. "Will you kindly receive my card?"

The cashier drew the small, spotless parallelogram inside the bars of his wicket, and read:

J. F. C. NETTLEWICK  
NATIONAL BANK EXAMINER

"Oh—er—will you walk around inside, Mr.—er—Nettlewick. Your first visit—didn't know your business, of course. Walk right around, please."

The examiner was quickly inside the sacred precincts of the bank, where he was ponderously introduced to each employee in turn by Mr. Edlinger, the cashier—a middle-aged gentleman of deliberation, discretion, and method.

"I was kind of expecting Sam Turner round again, pretty soon," said Mr. Edlinger. "Sam's been examining us now for about four years. I guess you'll find us all right, though considering the tightness in business. Not overly much money on hand, but able to stand the storms, sir, stand the storms."

"Mr. Turner and I have been ordered by the Comptroller to exchange districts," said the examiner, in his decisive, formal tones. "He is covering my old territory in southern Illinois and Indiana. I will take the cash first, please."

Perry Dorsey, the teller, was already arranging his cash on the counter for the examiner's inspection. He knew it was right to a cent, and he had nothing to fear, but he was nervous and flustered. So was every man in the bank. There was something so icy and swift, so impersonal and uncompromising about this man that his very presence seemed an accusation. He looked to be a man who would never make nor overlook an error.

*Friends in San Rosario*

THE WEST-BOUND stopped at San Rosario on time at 8:20 A.M. A man with a thick black-leather wallet under his arm left the train and walked rapidly up the main street of the town. There were other passengers who also got off at San Rosario, but they either slouched limberly over to the railroad eating-house or the Silver Dollar saloon, or joined the groups of idlers about the station.

Indecision had no part in the movements of the man with the wallet. He was short in stature, but strongly built, with very light, closely trimmed hair, smooth, determined face, and aggressive, gold-rimmed nose glasses. He was well dressed in the prevailing Eastern style. His air denoted a quiet but conscious reserve force, if not actual authority.

After walking a distance of three squares he came to the center of the town's business area. Here another street of importance crossed the main one, forming the hub of San Rosario's life and commerce. Upon one corner stood the postoffice. Upon another Rubensky's Clothing Emporium. The other two diagonally opposing corners were occupied by the town's two banks, the First National and the Stockmen's National. Into the First National Bank of San Rosario the newcomer walked, never slowing his brisk step until he stood at the cashier's window. The bank opened for business at nine, and the working force was already assembled, each member preparing his department for the day's business. The cashier was examining the mail when he noticed the stranger standing at his window.



Mr. Nettlewick first seized the currency, and with a rapid, almost juggling motion, counted it by packages. Then he spun the sponge cup toward him and verified the count by bills. His thin, white fingers flew like some expert musician's upon the keys of a piano. He dumped the gold upon the counter with a crash, and the coins whined and sang as they skimmed across the marble slab from the tips of his nimble digits. The air was full of fractional currency when he came to the halves and quarters. He counted the last nickel and dime. He had the scales brought, and he weighed every sack of silver in the vault. He questioned Dorsey concerning each of the cash memoranda—certain checks, charge slips, etc., carried over from the previous day's work—with unimpeachable courtesy, yet with something so mysteriously momentous in his frigid manner, that the teller was reduced to pink cheeks and a stammering tongue.

This newly imported examiner was so different from Sam Turner. It had been Sam's way to enter the bank with a shout, pass the cigars, and tell the latest stories he had picked up on his rounds. His customary greeting to Dorsey had been, "Hello, Perry! Haven't skipped out with the boodle yet, I see." Turner's way of counting the cash had been different too. He would finger the packages of bills in a tired kind of way, and then go into the vault and kick over a few sacks of silver, and the thing was done. Halves and quarters and dimes? Not for Sam Turner. "No chicken feed for me," he would say when they were set before him. "I'm not in the agricultural department." But, then, Turner was a Texan, an old friend of the bank's president, and had known Dorsey since he was a baby.

While the examiner was counting the cash, Major Thomas B. Kingman—known to every one as "Major Tom"—the president of the First National, drove up to the side door with his old dun horse and buggy, and came inside. He saw the examiner busy with the money, and, going into the little "pony corral," as he called it, in which his desk was railed off, he began to look over his letters.

Earlier, a little incident had occurred that even the sharp eyes of the examiner had failed to notice. When he had begun his work at the cash counter, Mr. Edlinger had winked significantly at Roy Wilson, the youthful bank messenger, and nodded his head slightly toward the front door. Roy understood, got his hat and walked leisurely out, with his collector's book under his arm. Once outside, he made a beeline for the Stockmen's National. That bank was also getting ready to open. No customers had, as yet, presented themselves.

"Say, you people!" cried Roy, with the familiarity of youth and long acquaintance, "you want to get a move on you. There's a new bank examiner over at the First, and he's a stem-winder. He's counting nickels on Perry, and he's got the whole outfit bluffed. Mr. Edlinger gave me the tip to let you know."

Mr. Buckley, president of the Stockmen's National—a stout, elderly man, looking like a farmer dressed for Sunday—heard Roy from his private office at the rear and called him.

"Has Major Kingman come down to the bank yet?" he asked of the boy.

"Yes, sir, he was just driving up as I left," said Roy.

"I want you to take him a note. Put it into his own hands as soon as you get back."

Mr. Buckley sat down and began to write.

Roy returned and handed to Major Kingman the envelope containing the note. The major read it, folded it, and slipped it into his vest pocket. He leaned back in his chair for a few moments as if he were meditating deeply, and then rose and went into the vault. He came out with the bulky, old-fashioned leather note case stamped on the back in gilt letters, "Bills Discounted." In this were the notes due the bank with their attached securities, and the major, in his rough way, dumped the lot upon his desk and began to sort them over.

By this time Nettlewick had finished his count of the cash. His pencil fluttered like a swallow over the sheet of paper on which he had set his figures. He opened his black wallet, which

seemed to be also a kind of secret memorandum book, made a few rapid figures in it, wheeled and transfixed Dorsey with the glare of his spectacles. That look seemed to say: "You're safe this time, but—"

"Cash all correct," snapped the examiner. He made a dash for the individual bookkeeper, and, for a few minutes there was a fluttering of ledger leaves and a sailing of balance sheets through the air.

"How often do you balance your pass-books?" he demanded, suddenly.

"Er—once a month," faltered the individual bookkeeper, wondering how many years they would give him.

"All right," said the examiner, turning and charging upon the general bookkeeper, who had the statements of his foreign banks and their reconciliation memoranda ready. Everything there was found to be all right. Then the stub book of the certificates of deposit. Flutter—flutter—zip—zip—check! All right, list of overdrafts, please. Thanks. H'm-m. Unsigned bills of the bank next. All right.

Then came the cashier's turn, and easy-going Mr. Edlinger rubbed his nose and polished his glasses nervously under the quick fire of questions concerning the circulation, undivided profits, bank real estate, and stock ownership.

Presently Nettlewick was aware of a big man towering above him at his elbow—a man sixty years of age, rugged and hale, with a rough, grizzled beard, a mass of gray hair, and a pair of penetrating blue eyes that confronted the formidable glasses of the examiner without a flicker.

"Er—Major Kingman, our president—er—Mr. Nettlewick," said the cashier.

Two men of very different types shook hands. One was a finished product of the world of straight lines, conventional methods, and formal affairs. The other was something freer, wider, and nearer to nature. Tom Kingman had not been cut to any pattern. He had been mule-driver, cowboy, ranger, soldier, sher-

iff, prospector and cattleman. Now, when he was bank president, his old comrades from the prairies, of the saddle, tent, and trail, found no change in him. He had made his fortune when Texas cattle were at the high tide of value, and had organized the First National Bank of San Rosario. In spite of his largeness of heart and sometimes unwise generosity toward his old friends, the bank had prospered, for Major Tom Kingman knew men as well as he knew cattle. Of late years the cattle business had known a depression, and the major's bank was one of the few whose losses had not been great.

"And now," said the examiner, briskly, pulling out his watch, "the last thing is the loans. We will take them up now, if you please."

He had gone through the First National at almost record-breaking speed—but thoroughly, as he did everything. The running order of the bank was smooth and clean, and that had facilitated his work. There was but one other bank in the town. He received from the Government a fee of twenty-five dollars for each bank that he examined. He should be able to go over those loans and discounts in half an hour. If so, he could examine the other bank immediately afterward, and catch the 11:45, the only other train that day in the direction he was working. Otherwise, he would have to spend the night and Sunday in this uninteresting Western town. That was why Mr. Nettlewick was rushing matters.

"Come with me, sir," said Major Kingman, in his deep voice, that united the Southern drawl with the rhythmic twang of the West. "We will go over them together. Nobody in the bank knows those notes as I do. Some of 'em are a little wobbly on their legs, and some are mavericks without extra many brands on their backs, but they'll 'most all pay out at the round-up."

The two sat down at the president's desk. First, the examiner went through the notes at lightning speed, and added up their total, finding it to agree with the amount of loans carried on the book of daily balances. Next, he took up the larger loans, inquiring scrupulously into the condition of their endorers or

securities. The new examiner's mind seemed to course and turn and make unexpected dashes hither and thither like a bloodhound seeking a trail. Finally he pushed aside all the notes except a few, which he arranged in a neat pile before him, and began a dry, formal little speech.

"I find, sir, the condition of your bank to be very good, considering the poor crops and the depression in the cattle interests of your state. The clerical work seems to be done accurately and punctually. Your past-due paper is moderate in amount, and promises only a small loss. I would recommend the calling in of your large loans, and the making of only sixty and ninety day or call loans until general business revives. And now, there is one thing more, and I will have finished with the bank. Here are six notes aggregating something like \$40,000. They are secured, according to their faces, by various stocks, bonds, shares, etc., to the value of \$70,000. Those securities are missing from the notes to which they should be attached. I suppose you have them in the safe or vault. You will permit me to examine them."

Major Tom's light-blue eyes turned unflinchingly toward the examiner.

"No, sir," he said, in a low but steady tone; "those securities are neither in the safe nor the vault. I have taken them. You may hold me personally responsible for their absence."

Nettlewick felt a slight thrill. He had not expected this. He had struck a momentous trail when the hunt was drawing to a close.

"Ah!" said the examiner. He waited a moment, and then continued: "May I ask you to explain more definitely?"

"The securities were taken by me," repeated the major. "It was not for my own use, but to save an old friend in trouble. Come in here, sir, and we'll talk it over."

He led the examiner into the bank's private office at the rear, and closed the door. There was a desk, and a table, and half-a-dozen leather-covered chairs. On the wall was the mounted head of a Texas steer with horns five feet from tip to tip. Opposite

hung the major's old cavalry saber that he had carried at Shiloh and Fort Pillow.

Placing a chair for Nettlewick, the major seated himself by the window, from which he could see the post-office and the carved limestone front of the Stockmen's National. He did not speak at once, and Nettlewick felt, perhaps, that the ice should be broken by something so near its own temperature as the voice of official warning.

"Your statement," he began, "since you have failed to modify it, amounts, as you must know, to a very serious thing. You are aware, also, of what my duty must compel me to do. I shall have to go before the United States Commissioner and make——"

"I know, I know," said Major Tom, with a wave of his hand. "You don't suppose I'd run a bank without being posted on national banking laws and the revised statutes! Do your duty. I'm not asking any favors. But I spoke of my friend. I did want you to hear me tell about Bob."

Nettlewick settled himself in his chair. There would be no leaving San Rosario for him that day. He would have to telegraph to the Comptroller of the Currency; he would have to swear out a warrant before the United States Commissioner for the arrest of Major Kingman; perhaps he would be ordered to close the bank on account of the loss of the securities. It was not the first crime the examiner had unearthed. Once or twice the terrible upheaval of human emotions that his investigations had loosed had almost caused a ripple in his official calm. He had seen bank men kneel and plead and cry like women for a chance—an hour's time—the overlooking of a single error. One cashier had shot himself at his desk before him. None of them had taken it with the dignity and coolness of this stern old Westerner. Nettlewick felt that he owed it to him at least to listen if he wished to talk. With his elbow on the arm of his chair, and his square chin resting upon the fingers of his right hand, the bank examiner waited to hear the confession of the president of the First National Bank of San Rosario.

"When a man's your friend," began Major Tom, somewhat dactically, "for forty years, and tried by water, fire, earth, and cyclones, when you can do him a little favor you feel like doing it."

("Embezzle for him \$70,000 worth of securities," thought the examiner.)

"We were cowboys together, Bob and I," continued the major, speaking slowly, and deliberately, and musingly, as if his thoughts were rather with the past than the critical present, "and we prospect together for gold and silver over Arizona, New Mexico, and a good part of California. We were both in the war of sixty-one, but in different commands. We've fought Indians and horse thieves side by side; we've starved for weeks in a cabin in the Arizona mountains, buried twenty feet deep in snow; we've ridden herd together when the wind blew so hard the lightning couldn't strike—well, Bob and I have been through some rough spells since the first time we met in the branding camp of the old Anchor-Bar ranch. And during that time we've found it necessary more than once to help each other out of tight places. In those days it was expected of a man to stick to his friend, and he didn't ask any credit for it. Probably next day you'd need him to get at your back and help stand off a band of Apaches, or put a tourniquet on your leg above a rattlesnake bite and ride for whisky. So, after all, it was give and take, and if you didn't stand square with your pardner, why, you might be shy one when you needed him. But Bob was a man who was willing to go further than that. He never played a limit.

"Twenty years ago I was sheriff of this county and I made Bob my chief deputy. That was before the boom in cattle when we both made our stake. I was sheriff and collector, and it was a big thing for me then. I was married, and we had a boy and a girl—a four and a six year old. There was a comfortable house next to the courthouse, furnished by the county, rent free, and I was saving some money. Bob did most of the office work. Both of us had seen rough times and plenty of rustling and danger, and I

tell you it was great to hear the rain and the sleet dashing against the windows of nights, and be warm and safe and comfortable, and know you could get up in the morning and be shaved and have folks call you 'mister.' And then, I had the finest wife and kids that ever struck the range, and my old friend with me enjoying the first fruits of prosperity and white shirts, and I guess I was happy. Yes, I was happy about that time."

The major sighed and glanced casually out of the window. The bank examiner changed his position, and leaned his chin upon his other hand.

"One winter," continued the major, "the money for the county taxes came pouring in so fast that I didn't have time to take the stuff to the bank for a week. I just shoved the checks into a cigar box and the money into a sack, and locked them in the big safe that belonged in the sheriff's office.

"I had been overworked that week, and was about sick, anyway. My nerves were out of order, and my sleep at night didn't seem to rest me. The doctor had some scientific name for it, and I was taking medicine. And so, added to the rest, I went to bed at night with that money on my mind. Not that there was much need of being worried, for the safe was a good one, and nobody but Bob and I knew the combination. On Friday night there was about \$6,500 in cash in the bag. On Saturday morning I went to the office as usual. The safe was locked, and Bob was writing at his desk. I opened the safe, and the money was gone. I called Bob, and roused everybody in the courthouse to announce the robbery. It struck me that Bob took it pretty quiet, considering how much it reflected upon both him and me.

"Two days went by and we never got a clew. It couldn't have been burglars, for the safe had been opened by the combination in the proper way. People must have begun to talk, for one afternoon in comes Alice—that's my wife—and the boy and girl, and Alice stamps her foot, and her eyes flash, and she cries out, 'The lying wretches—Tom, Tom!' and I catch her in a faint, and bring her 'round little by little, and she lays her head down and cries

and cries for the first time since she took Tom Kingman's name and fortunes. And Jack and Zilla—the youngsters—they were always wild as tigers cubs to rush at Bob and climb all over him whenever they were allowed to come to the courthouse—they stood and kicked their little shoes, and herded together like scared partridges. They were having their first trip down into the shadows of life. Bob was working at his desk, and he got up and went out without a word. The grand jury was in session then, and the next morning Bob went before them and confessed that he stole the money. He said he lost it in a poker game. In fifteen minutes they had found a true bill and sent me the warrant to arrest the man with whom I'd been closer than a thousand brothers for many a year.

"I did it, and then I said to Bob, pointing: 'There's my house, and here's my office, and up there's Maine, and out that way is California, and over there is Florida—and that's your range 'til court meets. You're in my charge, and I take the responsibility. You be here when you're wanted.'

"Thanks, Tom," he said, kind of carelessly; "I was sort of hoping you wouldn't lock me up. Court meets next Monday, so, if you don't object, I'll just loaf around the office until then. I've got one favor to ask, if it isn't too much. If you'd let the kids come out in the yard once in a while and have a romp I'd like it."

"Why not?" I answered him. "They're welcome, and so are you. And come to my house the same as ever." You see, Mr. Nettlewick, you can't make a friend of a thief, but neither can you make a thief of a friend, all at once."

The examiner made no answer. At that moment was heard the shrill whistle of a locomotive pulling into the depot. That was the train on the little, narrow-gauge road that struck into San Rosario from the south. The major cocked his ear and listened for a moment, and looked at his watch. The narrow-gauge was in on time—10:35. The major continued.

"So Bob hung around the office, reading the papers and snok-

ing, I put another deputy to work in his place, and, after a while, the first excitement of the case wore off.

"One day when we were alone in the office Bob came over to where I was sitting. He was looking sort of grim and blue—the same look he used to get when he'd been up watching for Indians all night or herd-riding.

"Tom," says he, "it's harder than standing off redskins; it's harder than lying in the lava desert forty miles from water; but I'm going to stick it out to the end. You know that's been my style. But if you'd tip me the smallest kind of a sign—if you'd just say, 'Bob I understand,' why, it would make it lots easier."

"I was surprised. 'I don't know what you mean, Bob,' I said. 'Of course, you know that I'd do anything under the sun to help you that I could. But you've got me guessing.'

"All right, Tom," was all he said, and he went back to his newspaper and lit another cigar.

"It was the night before the court met when I found out what he meant. I went to bed that night with the same old, light-headed, nervous feeling come back upon me. I dropped off to sleep about midnight. When I woke I was standing half dressed in one of the courthouse corridors. Bob was holding one of my arms, our family doctor the other and Alice was shaking me and half crying. She had sent for the doctor without my knowing it, and when he came they had found me out of bed and missing, and had begun a search.

"Sleep-walking," said the doctor.

"All of us went back to the house, and the doctor told us some remarkable stories about the strange things people had done while in that condition. I was feeling rather chilly after my trip out, and, as my wife was out of the room at the time, I pulled open the door of an old wardrobe that stood in the room and dragged out a big quilt I had seen in there. With it tumbled out the bag of money for stealing which Bob was to be tried—and convicted—in the morning.

"How the jumping rattlesnakes did that get there?" I yelled,

and all hands must have seen how surprised I was. Bob knew in a flash.

"'You darned old snoozer,' he said, with the old-time look on his face, 'I saw you put it there. I watched you open the safe and take it out, and I followed you. I looked through the window and saw you hide it in that wardrobe.'

"'Then, you blankety-blank, flop-eared, sheep-headed coyote, what did you say you took it for?'

"'Because,' said Bob, simply, 'I didn't know you were asleep.'

"'I saw him glance toward the door of the room where Jack and Zilla were, and I knew then what it meant to be a man's friend from Bob's point of view.'

Major Tom paused, and again directed his glance out of the window. He saw someone in the Stockmen's National Bank reach and draw a yellow shade down the whole length of its plate-glass, big front window, although the position of the sun did not seem to warrant such a defensive movement against its rays.

Nettlewick sat up straight in his chair. He had listened patiently, but without consuming interest, to the major's story. It had impressed him as irrelevant to the situation, and it could certainly have no effect upon the consequences. Those Western people, he thought, had an exaggerated sentimentality. They were not business-like. They needed to be protected from their friends. Evidently the major had concluded. And what he had said amounted to nothing.

"May I ask," said the examiner, "if you have anything further to say that bears directly upon the question of those abstracted securities?"

"Abstracted securities, sir!" Major Tom turned suddenly in his chair, his blue eyes flashing upon the examiner. "What do you mean, sir?"

He drew from his coat pocket a batch of folded papers held together by a rubber band, tossed them into Nettlewick's hands, and rose to his feet.

"You'll find those securities there, sir, every stock, bond, and

share of 'em. I took them from the notes while you were counting the cash. Examine and compare them for yourself."

The major led the way back into the banking room. The examiner, astounded, perplexed, nettled, at sea, followed. He felt that he had been made the victim of something that was not exactly a hoax, but that left him in the shoes of one who had been played upon, used, and then discarded, without even an inking of the game. Perhaps, also, his official position had been irreverently juggled with. But there was nothing he could take hold of. An official report of the matter would be an absurdity. And, somehow, he felt that he would never know anything more about the matter than he did then.

Frigidly, mechanically, Nettlewick examined the securities, found them to tally with the notes, gathered his black wallet, and rose to depart.

"I will say," he protested, turning the indignant glare of his glasses upon Major Kingman, "that your statements—your misleading statements, which you have not condescended to explain—do not appear to be quite the thing, regarded either as business or humor. I do not understand such motives or actions."

Major Tom looked down at him serenely and not unkindly.

"Son," he said, "there are plenty of things in the chaparral, and on the prairies, and up the cañons that you don't understand. But I want to thank you for listening to a garrulous old man's prosy story. We old Texans love to talk about our adventures and our old comrades, and the home folks have long ago learned to run when we begin with 'Once upon a time,' so we have to spin our yarns to the stranger within our gates."

The major smiled, but the examiner only bowed coldly, and abruptly quitted the bank. They saw him travel diagonally across the street in a straight line and enter the Stockmen's National Bank.

Major Tom sat down at his desk and drew from his vest pocket the note Roy had given him. He had read it once, but hurriedly,

and now, with something like a twinkle in his eyes, he read it again. These were the words he read:

Dear Tom:

I hear there's one of Uncle Sam's greyhounds going through you, and that means that we'll catch him inside of a couple of hours, maybe. Now, I want you to do something for me. We've got just \$2,200 in the bank, and the law requires that we have \$20,000. I let Ross and Fisher have \$18,000 late yesterday afternoon to buy up that Gibson bunch of cattle. They'll realize \$40,000 in less than thirty days on the transaction, but that won't make my cash on hand look any prettier to that bank examiner. Now, I can't show him those notes, for they're just plain notes of hand without any security in sight, but you know very well that Pink Ross and Jim Fisher are two of the finest white men God ever made, and they'll do the square thing. You remember Jim Fisher—he was the one who shot that faro dealer in El Paso. I wired Sam Bradshaw's bank to send me \$20,000, and it will get in on the narrow-gauge at 10:35. You can't let a bank examiner in to count \$2,200 and close your doors. Tom, you hold that examiner. Hold him. Hold him if you have to rope him and sit on his head. Watch our front window after the narrow-gauge gets in, and when we've got the cash inside we'll pull down the shade for a signal. Don't turn him loose till then. I'm counting on you, Tom.

Your Old Pard,

Bob Buckley,

*Prest. Stockmen's National*

The major began to tear the note into small pieces and throw them into his waste basket. He gave a satisfied little chuckle as he did so.

"Confounded old reckless cowpuncher!" he growled, contentedly, "that pays him some on account for what he tried to do for me in the sheriff's office twenty years ago."

## VITA

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The author was born on September 26, 1964 in Belle Haven, Virginia. She received her Bachelor of Arts in English from James Madison University in May, 1986, and entered the Master of Arts program in psychology at the College of William and Mary in August, 1988. Her first year project, entitled "The Relationship between Self-Report Measures of Schizotypy and Cognitive Performance," was presented to the Southwestern Psychological Association in April, 1990.