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Individual Differences in Comparison Question Anxiety

The comparison question polygraph test (CQT) is a well-known technique for the detection of deception in legal and criminal settings (Raskin et al., 1989). According to Raskin and colleagues, the CQT was developed to address the limitations of the relevant-irrelevant (R-I) test, which uses only two types of questions, relevant and neutral. In the R-I test, neutral questions do not have any salience (i.e. are not relevant) for the innocent examinee. In this sense, they function as a "control" condition. However, there is no method for determining if the observed reactions to relevant questions are caused by deception or by other factors, such as anxiety, examiner demeanor, or simply the accusatory nature of the questions. In the CQT, according to Raskin and colleagues, examinees are presented with three types of questions: relevant, comparison, and irrelevant questions. Comparison questions (CQs) are designed to give innocent examinees a chance to be more concerned with questions other than the relevant questions. In this way, they function as

a "placebo" condition (hence the term comparison instead of control). CQs are salient to innocent examinees, but do not directly relate to the specific event probed by relevant questions.

Honts (1994) addressed a series of fundamental assumptions that must be upheld in order for a CQT to be sensitive to deception on relevant questions. The first assumption is that individuals attempting to lie to the central issues will respond with greater physiological reactivity to the relevant questions. The second assumption is that although innocent individuals know that the relevant questions are important, they will have greater responses to the CQs.

Examiners base this assumption on the reasoning that innocent examinees know they did not commit the crime in the relevant questions, but they are either lying or uncertain about their responses to the CQs. In order to create conditions of uncertainty, CQs must be similar to the central issue but be more vague, cover more time, and be more general (Raskin et al., 1989). There are two types of CQs: exclusive and non-exclusive or inclusive. An exclusive comparison is a question of the same type or category as the relevant issue but excludes the relevant issue by use of a time constraint (Krapohl, Sturm, 2002). An example of an exclusive comparison question would be "Did you ever rob a bank before October 15th, 2005?" A non-exclusive or inclusive comparison question overlaps the relevant issue by time or location (Krapohl, Sturm, 2002). An example of a non-exclusive comparison question would be "Have you ever stolen anything in your life?"

The purpose of the comparison question is to elicit a fear of consequences (Reid, Inbau, 1977; Gustafson, Orne, 1963; Davis, 1961) or guilt in the innocent examinees.

The elicitation of guilt is loosely based on the concept of guilt complexes as originally discussed by Jung and Wertheimer (see Wertheimer et al., 1992 for a review). Both researchers separately applied association texts to deception detection using the word association test. This test delivers a prime word, and then participants respond with the word that most quickly comes to mind. The cognitively based spreading-activation theory of semantic processing (see Collins, Loftus, 1975 for a review) suggests that semantic primes elicit information organized within a loose construction of ideas. Priming words within a semantic network triggers activation of the entire network. For guilty individuals, relevant questions are associated with and activate information related to the central issue. For innocent individuals, the relevant questions deliver a less intense prime to the association network. The goal of the comparison question construction is to maximize primes associated with "guilt complexes" for innocent individuals.

Arising from the nature of CQT construction, an important issue in the effective use of CQs in polygraph examinations has been the proper selection and phrasing of CQs to suit each examinee (Harmon, Reid, 1955; Reid, 1947). Along those lines, Reid points out that if the examiner has information concerning an offense or situation involving the subject (of less importance than the pertinent crime), a comparison question based on the information will serve as a good indicator of the subject's responsiveness and will thus provide a good comparative response. According to Harmon and Reid, in selecting a section of CQs, an examiner should follow the following principles:

1. The question must be one to which the subject will answer "no".
2. Either the examiner should know from the facts in his possession that the subject's "no" answer is a lie, or he should be reasonably certain that the answer is untrue.
3. The examinee should believe that the question is important to the procedure and the final test results.
4. The question should concern a matter of lesser weight than the pertinent questions. (p. 579).

Since 1955, the general guidelines for constructing such CQs have remained unchanged and little work has been done to examine how individual differences influence responses to CQs. The overall goal of the current behavioral study is to examine, in a group of average college students, differences in guilt (as measured by anxiety related to responding) elicited by a group of CQs. Three potential mechanisms associated with priming guilt through comparison questions have been proposed. The first goal of the present study is to distinguish the mechanism that best describes the patterns of anxiety shown in this testing situation.

The first mechanism proposes that situational salience is responsible for differential patterns of responding to the questions (Vendemia, 2002). In a specific setting or situation, innocent examinees will show the strongest reactions to questions that are the most salient or threatening in that particular situation (Vendemia, 2002). For example, in a scenario where the CQT is given in a workplace setting, examinees are likely to show the strongest reactions to CQs concerning workplace infractions.

A study done by Bradley and Black (1998) provides evidence for the situational salience mechanism. This study manipulated the types of CQs given to students in a mock-crime study. Half of the students received CQs about cheating and plagiarism from a professor and half of the students received standard CQs. Bradley and Black reasoned that students would feel that it was undesirable or dangerous for a professor to conclude that they were cheaters or plagiarists. Results showed that the CQs oriented toward the aca-

demic context better distinguished between guilty and innocent individuals than standard questions. Therefore, participants were more likely to score as innocent when actually innocent. This was presumably because in a school setting, students are more likely to be concerned by infractions related to cheating and plagiarism than infractions present in the standard CQs.

The second mechanism stems from Kohlberg's theory of moral development (Kohlberg, Hersh, 1977; Snarey et al., 1985). Kohlberg proposes discreet stages of moral development, which every child passes through. In the first level, the preconventional level, children see right and wrong in terms of physical or hedonic consequences (e.g. reward and punishment) or in terms of the authority and power of those who enforce the rules (e.g. "If I do this, Mommy will yell at me"). In the second level, the conventional level, adolescents see right and wrong in terms of loyalty to social order and actively maintaining, supporting, and justifying the social order. In the third and last level, the postconventional level (reached by age 18 or later), there is an effort to define moral values and principles that have validity apart from social order or the authority of those enforcing the rules. This includes the development of universal principles of justice and respect for human rights.

This mechanism emphasizes one's current understanding of ethical reasoning as accounting for specific patterns of responding to CQs. This mechanism hypothesizes that the examinee's current stage of ethical development will determine which questions elicit the most guilt. For example, if someone is currently operating in the second, conventional level of moral reasoning, he/she will probably react most strongly to questions probing small violations that are designed to maintain the social order (e.g. substance use infractions).

Based on a moral reasoning theory developed by Carol Gilligan (1982, 1987, 1999), men and women develop different approaches to moral reasoning. Specifically, in her view, men see morality more in terms of justice. This concept of justice is based on abstract, rational principles by which all individuals will end up being treated fairly. Women, on the other hand, see morality more in terms of compassion, human relationships, and special responsibilities to those with whom an intimate relationship is shared. Women are more inclined to see morality as an issue of caring and relationships rather than of justice and rights.

The second goal of the present study is to examine possible sex differences in anxiety elicited by the different CQs. Examining sex differences is especially important and relevant because currently, the CQT is given without regard for sex differences in physiological responding. Despite this, sex has been identified as an important characteristic of the interviewee which may play

a role during the interrogation process (Vendemia, 2002). Therefore, examining sex differences in responding to CQs may help polygraph examiners better structure their interviews to suit individual differences. Because they develop different approaches to moral reasoning, men and women should see different types of questions as more threatening. Based on Gilligan's (1982, 1987, 1999) theories, one would expect women to respond more strongly to questions that deal with wrongs done to friends and family and questions that have less to do with fairness and justice and more to do with violating one's own moral standards. In contrast, one would expect men to react more strongly to questions that don't bear heavily on one's own moral code but are still considered "breaking the law" and can be punished.

The third mechanism proposes that examinees will show the strongest reactions to questions that deal with societal taboos. Such questions are likely to include infractions that are considered by society to be shameful. These questions are therefore likely to bring up feelings of shame and guilt in examinees and, as a result, evoke large physiological reactions. Recent work by Thonney and colleagues provides evidence for this mechanism. They conducted two studies, which compared the use of shame-arousing stimuli and neutral stimuli with the Guilty Knowledge Test. In both studies (Thonney et al., 2005 and 2006), the polygraph tests yielded significantly higher accuracy rates when the shame-arousing stimuli were used compared to when the neutral stimuli were used. In other words, examinees showed larger physiological responses to shame-arousing stimuli, which boosted the test's ability to classify individuals based on responsiveness.

We administered a questionnaire to undergraduates asking them to rate how anxious they would feel if faced with answering questions about their actions and character with negative consequences for "wrong" answers. The present study asks several research questions. Do the questions fall into different content categories based on participants' responses? Because the CQs vary quite widely, we predict that for a given group of people, the questions do fall into different content categories. Based on three potential mechanisms associated with priming guilt through comparison questions, the present study hypothesizes three possible specific patterns of differences among the predicted categories. First, if situational salience is operating in this case, students should rate questions concerning infractions likely to be committed by college students (minor legal infractions and rule breaking (e.g. substance use, cheating) as evoking higher anxiety than those less likely to be committed by college students. Second, if level of ethical reasoning is operating in this case, based on the theory that people change from social order maintenance to an independent ethical code as a moral guideline around age 18, students should rate

questions pertaining to personal ethics and integrity as evoking higher anxiety than other questions. Third, if societal taboos are operating in this case, questions pertaining to shameful conduct should be rated as evoking higher anxiety than other types.

Do men and women respond differently to these questions? Because women and men develop different approaches to moral reasoning, it is expected that their behavior to certain types of questions will be different. Specifically, it is expected that men will respond with more anxiety to questions pertaining to societal rules and regulations (not necessarily shameful or serious). It is also expected that women will respond with more anxiety to questions pertaining to wrongs against other people and one's own moral code.

Methods

Participants

Three hundred sixty-nine undergraduates at the University of South Carolina (USC) volunteered to participate in this online study. Of the original 386 respondents, 17 respondents were dropped because they failed to follow experimental procedure. Ages in the final sample ranged from 18 to 24 (M =19.06, SD = .83; women = 296, men = 73). The sample was 78% Caucasian, 14% African-American, 2% Asian, 2% Hispanic, 1% Native American, and 3% Other Ethnicity. This sample matched the demographic stratification of the university population. All participants received course credit and were recruited through the USC Psychology Department's online participation pool.

Measures

The measure used in this study was a questionnaire designed by members of our lab to assess anxiety elicited by polygraph test CQs. The measure consisted of 178 commonly used CQs. Questions were excluded from the measure if they contained offensive material or were incomprehensible for the average college student. Each question was followed by five possible answer choices: No Anxiety, Some Anxiety, Average Anxiety, Strong Anxiety, and Extreme Anxiety. In addition to the CQs, the questionnaire included five questions about demographic information. See Appendix A for a copy of the questions.

Procedure

Once participants signed up for the study via the online participation pool, they were directed to a website where they could fill out the questionnaire.

Three different versions of the questionnaire were constructed. All three versions had the same questions but in a different order. Participants were randomly assigned to fill out one of the three versions. Once at the website, participants first read an informed consent page and then agreed to consent to the study. Following this, they completed the questionnaire.

After completing the demographic information, the instructions told participants to: Imagine that you have just entered a room in which a man is seated behind a desk. He is reading from a folder labeled with your name. He asks you to take a seat. During the next hour, he will be asking you personal questions about your actions and character. 'Wrong' answers to these questions could have extremely negative consequences for your future. Please answer these questions and rate them as to how much anxiety each one would cause you to feel under those circumstances. Answer honestly. Your responses are completely anonymous.

Participants then completed the 178 items. After completing the questionnaire, they read a debriefing page explaining the purpose of the study and were thanked for their participation.

Results

The first part of the data analysis process consisted of basic data screening. The data were evaluated for mean, standard deviation, skewness, and kurtosis. Two of the questions, specifically "Were you ever involved in anything that would cause me to question your integrity?" and "Did you ever take any government supplies for your own use?", had very high skewness and kurtosis values as compared to the other questions in the data set. Histograms of these two questions were examined and they were both highly positively skewed. Because there were a large number of questions (178), these two questions were deleted from further analysis. In addition, during the original data entry, the data for nine questions were accidentally omitted, leaving 167 questions.

To potentially categorize the questions, a factor analysis extraction with an oblique Promax rotation was performed with SPSS on 167 items for the 369 participants. Factors with an Eigenvalue greater than one were retained. Ten factors were subsequently retained. After examining which questions loaded highest on each of the ten factors (factor loading of .5 and above), we labeled the factors based on the content of these questions. The resulting ten categories were Shameless Legal Infractions, Small Rules/Regulations Infractions, Personal Ethics Infractions, Personal Gain Infractions, Workplace Infractions, Moral Code Infractions, Shameful Infractions, Acquaintance Infractions, Integrity Infractions, and General Infractions (e.g. Did you ever break the law?). These categories explained approximately 56% of the variance in

the ratings. An average rating to the questions in each category was computed for each person. A new variable was then created to represent each category, the values of which were each person's average anxiety score to the subset of questions that represent each category.

A 2 X 10 MANOVA was used to assess the effects of infraction category and sex on average anxiety scores. Pairwise comparisons (Tukey's post-hoc tests) were used to compare the categories in order to test the three hypotheses for specific patterns of differences among the categories. Because sphericity could not be assumed, multivariate F-tests are reported. Overall, the anxiety scores to the questions tended to be low to moderate. As predicted, the main effect of infraction category was significant (F (9, 359) =13.68, $p < .05$, $\acute{\eta}^2$ = .26). The effect size indicates a moderate effect of infraction category. Means (with error bars representing one standard error) for the infraction categories are presented in Figure 1 below.

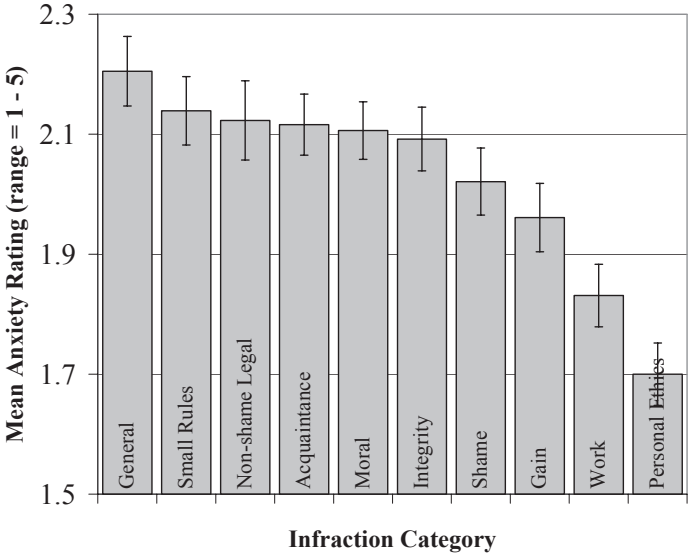

Figure 1. Average Anxiety Ratings for Infraction Categories in College Students (N=369).

Using Tukey's post-hoc tests, pairwise comparisons were performed on all the categories in order to compare them and test the three hypotheses for specific patterns of differences among the categories. Results of the pairwise comparisons are presented in Table I below. The first mechanism predicted that participants should rate questions concerning infractions likely to be committed by college students (shameless or minor legal infractions and rule

breaking (e.g. substance use infractions) as evoking higher anxiety than those unlikely to be committed by college students. In line with this explanation, General, Shameless Legal, and Small Rules/Regulations infractions, while not significantly different from each other, were significantly higher than most of the other categories. They also had the three highest means (Figure 1).

The second mechanism predicted that students should rate questions pertaining to personal ethics and integrity as evoking higher anxiety than other questions. In contrast to this explanation, the personal ethics category was actually significantly lower than all other categories. In addition, individuals rated the integrity category as significantly more anxiety provoking than only three other categories and its mean was in the middle of the category means (Figure 1). The third mechanism predicted that questions pertaining to shameful conduct should be rated as evoking higher anxiety than other types. In contrast, the Shameful category was significantly higher than only two other categories. In addition, the mean for shameful infractions was at the lower end of the category means (Figure 1.).

While the main effect of sex was significant (F (1, 367) = 4.42, $p < .05$, $\acute{\eta}^2$ = .012), with men (M = 2.11, SE = .07) reporting on average more anxiety than women (M = 1.95, SE = .04), as expected, the interaction between infraction category and sex was significant (F (9, 359) = 2.88, $p < .05$, $\acute{\eta}^2$ = .067). This indicates that the effect of sex differed as a function of category.

Table I. Significant Differences in Anxiety Ratings between Infraction Categories

	General	Small Rules	Non-shame Legal	Acquaint-ance	Moral	Integrity	Shame	Gain	Work	Personal Ethics
General	----			.089(.044)	.098(.048)	.113(.049)	.184(.054)	.244(.059	.373(.047)	.505 (.064)
Small Rules		----					.118(.051)	.178(.057)	.308(.058)	.439(.072)
Non-shame Legal			----					.162 (.08)	.291(.06)	.423(.073)
Acquaint-ance				----				.155(.063)	.285(.048)	.416(.059)
Moral					----			.145(.055)	.275(.047)	.407(.053)
Integrity						----		.131(.054)	.285(.048)	.416(.059)
Shame							----		.189(.051)	.321(.061)
Gain								----	.130(.061)	.261(.056)
Work									----	.132 (057)
Personal Ethics										----

Format: Mean difference (SE); Row > Column
All differences adjusted for multiple comparisons

Follow-up independent samples t-tests were done on the four categories that represented the hypothesized sex differences. The first hypothesis predicted that men would react with more anxiety to the Shameless Legal and Small Rules/Regulations categories. As predicted, men did react with more anxiety (mean difference = -.275, SE = .132) to the Shameless Legal category (t (367) = -2.077, $p < .05$, d = .267). The effect size indicates a small effect for this category. Although not significant, the anxiety increase in men for the Small Rules/Regulations category (mean difference = -.209, SE = .113) did approach significance. The second hypothesis predicted that women would react with more anxiety to the Acquaintance and Moral Code categories. In contrast to this prediction, men and women did not react differently to the Acquaintance category or the Moral Code category. Power analyses were conducted for these two effects using Monte Carlo power simulations, and the power to find each effect was .835 and .835 respectively.

Discussion

Overall, the anxiety scores tended to be low to moderate. This is presumably because the questions were not given in a formal exam scenario. In such a scenario, where the stakes are higher, elicited anxiety and, presumably, level of guilt may be greater. As expected, the questions could be put into content categories based on how much anxiety they elicited. This supports the notion alluded to earlier that for a given group of people, the nature of the reactions elicited by the CQs vary as a function of their content. The present study investigated three possible mechanisms associated with priming guilt through comparison questions as an explanation for specific patterns of differences among the categories. Situational salience (Vendemia, 2002) seems to be the best explanation for this situation. General, Small Rules, and Shameless Infractions, infractions commonly committed by college students, were rated higher than most other categories. These results are also in line with the findings in Bradley and Black (1998). Understanding of ethical reasoning and societal taboos do not seem to be appropriate explanations for the pattern of responses seen in this study.

Concerning understanding of ethical reasoning, it is possible that the students in this study have not progressed to the last level of ethical development and therefore the Personal Ethics and Integrity categories did not elicit higher levels of anxiety than the other categories. In fact, Kohlberg and Hersh (1977) point out that some people do not ever reach the third level of ethical reasoning. Concerning the societal taboos explanation, it seems that the students in this study did not find the Shameful Infractions more anxiety-

provoking than other categories. This is in contrast to findings in Thonney et al. (2005 and 2006). One possible reason why the Shameful Infractions did not elicit higher levels of anxiety compared to the other categories is that the present study did not include very shameful infractions that are obvious societal taboos (e.g. sexual offenses). These were not included because they were deemed inappropriate for the present study. Overall, however, it is plausible that the categories involved in the second and third explanations may not have elicited the highest levels of anxiety because unlike General, Small Rules, and Shameless Infractions, college students do not commit them frequently.

The present study hypothesized sex differences in four of the 10 categories. Specifically, we predicted that men would react with more anxiety to questions pertaining to shameless and minor law- and rule-breaking (Small Rules and Shameless) categories. As predicted, men did report more anxiety to the Small Rules and Shameless categories. However, these effects were small. These results are in line with Gilligan's (1982, 1987, 1999) theories regarding sex differences in development of moral reasoning.

It was also hypothesized that women would react more strongly to questions that deal with wrongs done to friends and family and questions that have less to do with fairness and justice and more to do with violating one's own moral standards (Acquaintance and Moral categories). Contrary to what was expected, women did not react with more anxiety to the Moral or Acquaintance categories. These results are not in line with Gilligan's (1982, 1987, 1999) theories. Power analyses were conducted on both these effects and this study had adequate power to find both effects. It seems, then, that in the data there were no differences between men and women in these two categories. It is possible that women were engaging in more self-monitoring than men. That is, women might have been reporting less anxiety than they actually felt because it would be more socially appropriate in this situation. In fact, several studies have found that women engage in more self-monitoring than men (e.g. Hall, 1984*;* Cole, 1986). Future research should include a self-monitoring scale to explore this possibility.

This study has several implications for the field of polygraph examination. The fact that the questions could be placed into content categories based on how much anxiety they elicit emphasizes that for an individual or group, not all CQs are created equal. Some may elicit more physiological arousal than others may during a polygraph exam. The findings emphasize the role of individual differences in the CQT and in turn the importance of taking into account those individual differences when constructing an exam. Specifically, it seems that Vendemia's (2002) situational salience theory may currently be

the best explanation for the pattern of differences in arousal seen during an exam. While more research clearly needs to be done, this may be the most efficient technique for polygraph examiners when constructing an exam for an individual, as the examiners will want to choose CQs that produce the largest amount of physiological arousal in the innocent examinee.

Although the findings produced mixed results concerning sex differences, it seems that there may be some differences in men and women concerning physiological arousal during an exam. While women may be self-monitoring during a low-stakes survey such as the present one, they may not be doing so in a true forensic exam scenario. Future endeavors should attempt to exam sex differences in a higher-stakes situation. The present study in combination with future research on the CQT may warrant a revision of administration of the CQT that takes into account sex differences in arousal levels.

Important to note is that the present investigation included only inclusive CQs. There has been an ongoing debate for some time regarding the relative importance of inclusive versus exclusive CQs in the CQT (see Gordon, Fleisher, 2006 for a recent discussion of this issue). While recent work suggests they may work equally well in a forensic exam scenario (F. Horvath, personal communication, January 25, 2008), it may be important for future research to take into account both types of questions.

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Appendix A.
Questionnaire Items

1. Did you ever do anything illegal?
2. Are you absolutely trustworthy?
3. Did you ever make false entries on an official form or document?
4. Did you ever violate a traffic law?
5. Did you ever commit a sin (and not ask forgiveness)?
6. Did you ever say something derogatory about another person behind his or her back?
7. Are you really an honest and trustworthy person?
8. Did you ever pass a bad check knowing you did not have adequate money in the bank?
9. Have you ever done anything which could cause scandal in your church?
10. Did you ever lie to a personal friend?
11. Did you ever lie to a previous supervisor?
12. Did you ever ask someone to cover up for you?
13. Did you ever possess anything illegally?
14. Did you ever lie to get even?
15. Did you ever reveal anyone's personal secret?
16. Did you ever disclose a secret that was told to you in confidence?
17. Did you ever lie to someone in a position of authority?
18. Have you ever misused police equipment?

19. Did you ever deliberately conduct yourself in a dishonorable manner?
20. Have you ever falsified your qualifications?
21. Did you ever intentionally lie to anyone about anything?
22. Have you ever spoken disrespectfully of other church members?
23. Have you ever witnessed a violation of the law and not taken appropriate action?
24. Did you ever knowingly violate any company rules or policies?
25. Did you ever lie for your protection?
26. Did you ever lie to protect your status?
27. Did you ever lie to suit your own interests?
28. Did you ever steal anything from your work place?
29. Did you ever lie to someone who trusted you?
30. Did you ever knowingly possess any stolen property?
31. Did you ever violate your own integrity?
32. Did you ever deliberately do anything dishonest?
33. Did you ever say something that you later regretted?
34. Did you ever lie to a child about anything?
35. Are you the type of person who would betray a friend?
36. Did you ever involve yourself in black-market activity?
37. Did you ever violate a hunting law?
38. Did you ever lie to get out of trouble?
39. If there were something that might limit your access to classified information would you tell me about it?
40. Did you ever lie to a policeman?
41. Did you ever hide any information from a personal friend?
42. Did you ever spread malicious gossip or rumors about anyone?
43. Did you ever do anything in your personal life of which you are not proud?
44. Did you ever violate your own professional ethics code?
45. Did you ever lie to a cop?
46. Did you ever do anything for which you could lose your job?
47. Did you ever deliberately lie to your boss?
48. Did you ever do anything in school (college) that you are now ashamed of doing?
49. Would anyone that knows you well describe you as a difficult person?
50. Were you ever involved in anything that would cause me to question your integrity?
51. Have you ever accepted anything of value from business people?
52. Did you ever say anything about someone that wasn't true?
53. Did you ever do anything to get even?

54. Did you ever reveal a confidence entrusted to you by a relative?
55. Are you the type of person who would take credit for someone else's work?
56. Did you ever lie to make yourself important?
57. Have you ever falsely represented your background data?
58. Did you ever misrepresent the facts to gain some benefit?
59. Did you ever betray anyone who placed total trust in you?
60. Did you ever commit a criminal offense?
61. Did you ever steal anything from a friend?
62. Are you the type of person who occasionally drinks too much?
63. Did you ever fail to accept responsibility for your own actions?
64. Did you ever spread malicious gossip about anyone?
65. Have you ever padded an expense account?
66. Are you the kind of person that feels it is acceptable to lie to get what you want?
67. Do you ever gossip or rumor about other church members?
68. Did you ever possess anything for which you could have been arrested?
69. Did you ever take any government supplies for your personal use?
70. Did you ever falsify any document to obtain credit or a loan?
71. Did you ever cheat in school?
72. Did you ever misrepresent the facts to protect yourself?
73. Did you ever cheat?
74. Did you reveal information entrusted to you by a friend or relative?
75. Did you ever take credit for something you really did not do?
76. Did you ever take police equipment for your personal use?
77. Did you ever do anything that could bring shame upon yourself or your family?
78. Have you ever disrespectfully criticized your minister (Priest, Rabbi, etc)?
79. Did you ever steal government property?
80. Did you ever lie to a close friend about anything?
81. Did you ever try to deceive someone by lying?
82. Did you ever hide a safe combination in an unauthorized location for your personal convenience?
83. Did you ever lie to make yourself look important?
84. Did you ever take credit for something you did not do?
85. Are you the type of person that talks about people behind their backs?
86. Could you be accused of not working a full day while receiving a full day's pay?
87. Did you ever steal anything from your employer?

88. Have you ever mistreated a person under arrest?
89. Did you ever speak disrespectfully of any boss or supervisor?
90. Did you ever possess any item you weren't supposed to?
91. Did you ever lie to avoid the responsibilities for your actions?
92. Did you ever hide any information from a relative?
93. Have you ever padded your expense account?
94. Did you ever make false entries on a claim?
95. Did you ever possess any contraband?
96. Did you ever ask someone to lie for you?
97. Did you ever steal anything from someone who trusted you?
98. Would anyone that knows you describe you as a person who enjoys manipulating friends?
99. Have you ever lied to a superior officer?
100. Did you ever lie to get out of an obligation?
101. Did you ever abuse a position of trust?
102. Did you ever disclose a personal secret furnished to you by a friend?
103. Did you ever deliberately lie to someone who really trusted you?
104. Are you the type of person who would betray the trust of a friend?
105. Did you ever lie to get out of an obligation?
106. Did you ever steal anything from a relative?
107. Are you the type of person who would lie if you made a mistake?
108. Did you ever do anything while drinking that you are now ashamed of doing?
109. Did you ever take any company supplies for your personal use?
110. Have you ever lied to a co-worker (partner)?
111. Did you ever deliberately do anything unethical?
112. Did you ever misuse your position for personal profit or gain?
113. Have you ever make any false claim for reimbursement?
114. Have you ever submitted a false claim for expenses?
115. Did you ever violate an honor code?
116. Did you ever make false entries on an employment application?
117. Are you the type of person who cannot be trusted with a personal secret or confidence?
118. Did you ever deliberately lie to someone in authority for any reason at all?
119. Did you ever disclose a friend's secret that had been told to you in confidence?
120. Have you ever shoplifted anything from a store?
121. Did you ever lie to make yourself more important?
122. Did you ever cheat on your time card?

123. Did you ever deliberately provide false or misleading information on any official document?
124. Did you ever steal anything from your government?
125. Have you ever lied on a deposition?
126. Did you ever violate any of the laws of the US?
127. Are you completely honest with others who trust you?
128. Did you ever misrepresent the truth to gain some benefit?
129. Did you ever betray the trust of a friend?
130. Did you ever lie to a relative about anything?
131. Have you ever discussed sensitive police information with persons who did not have the need to know?
132. Did you ever do anything illegal in your country?
133. Did you ever falsify a form for personal gain?
134. Did you ever steal anything and not get caught?
135. Have you ever falsified your accomplishments?
136. Have you ever conducted personal business on company time?
137. Did you ever lie to keep from getting in trouble?
138. Did you ever make false entries on a report?
139. Did you ever say something in anger that you later regretted?
140. Did you ever possess any illegal substance?
141. Did you ever reveal a confidence entrusted to you by a friend?
142. Have you ever lied on a police document or report?
143. Did you ever obtain anything by unlawful means?
144. Did you ever lie to a relative?
145. Did you ever cheat in school?
146. Did you ever steal anything of value?
147. Did you ever disregard a rule or regulation because you thought it was necessary?
148. Did you ever cheat on your time card?
149. Did you ever lie because you thought you would not get caught?
150. Did you ever deliberately do anything dishonest?
151. Would any of your fellow employees describe you as someone who is difficult to work with?
152. Did you ever falsify a form for personal gain?
153. Did you ever betray the trust of a relative?
154. Did you ever lie to protect your position?
155. Did you ever violate any of the laws of your country?
156. Did you ever violate a fishing law?
157. Did you ever say anything about someone that wasn't true?
158. Did you ever take credit for something you did not do?

159. Did you ever reveal the answers to an examination?
160. Did you ever involve yourself in customs violations activity?
161. Have you ever lied in court?
162. Did you ever help a fellow officer cover up a mistake?
163. Did you ever do anything that you would be ashamed to tell someone about?
164. Did you ever do anything that could cause you a loss of position or status?
165. Did you ever lie to a previous coworker?
166. Did you ever misrepresent the facts for personal gain?
167. Did you ever lie to cover up a mistake?
168. Did you ever steal company property?
169. Did you ever disregard or flaunt a rule or regulation because you thought it was foolish or unnecessary?
170. Would anyone that knows you well describe you as someone they did not trust?
171. Did you ever hurt someone who trusted you?
172. Did you ever intentionally mislead or deceive your friends?
173. Did you ever do anything for which you could be fired?
174. Did you ever violate your own code of ethics?
175. Did you ever do anything that you want to keep hidden?
176. Have you ever done anything that would cause me to question your integrity?
177. Would any of your co-workers characterize you as being dishonest, unethical, or incompetent?
178. Did you ever do anything which would reflect negatively on your character?

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Ways of Revealing Resistance Against Polygraph Testing

It is logical to assume that practically all examined persons involved in events under investigation in one form or another (skilfully or unskilfully) try to resist a polygraph. Considering the easy access to information on modern technologies of carrying out psychophysiological tests in screening (PPT) and ways of fighting against them, the problem of effective attempts at resistance becomes rather relevant. Access to information for non-professionals both as a method of polygraph testing and as a way of counteracting it not only represents a danger from the point of view of decrease in accuracy and

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reliability of results of specific tests, but also, unfortunately, leads to great harm to the professional image as a whole.

The urgency of the problem of fighting such resistance can also be proved by the fact that all the basic members of USA intelligence associations that use polygraphs in their activities – the Ministry of Defence, FBI, Secret Service and many other special services – continue to carry out various closed research on the efficiency of how to resist a polygraph and ways of defeating this resistance. It is especially important to emphasize that the best-known psychophysiologists and experts in the field of using a polygraph, such as David Raskin, David Lykken, Charles Honts and many others, have been and continue to be involved in this research.

Analysis of the problem of resistance against the polygraph

In the practice of polygraph tests the following should be understood as resistance: *any deliberate actions of a person involved in an event under investigation attempting to distort his/her reactions with the purpose of avoiding disclosure.*

From this definition it follows that the attempts of some tested persons to control their physiological reactions, for example breathing, with the purpose of reducing or not showing excitement, cannot be regarded as resistance if the task of cheating a polygraph is not the cause. Besides, a non-involved examinee may try to make distortions in the reactions registered just because of a sporting interest, a wish to contradict, or a desire to prove personal superiority over a method. As a rule, such attempts are taken at an initial (pre-test) stage of an examination and are not used at the stage of the basic test due to the competent actions of a polygraphist.

The inadequate behaviour of the examinee should not be taken as a step of resistance that has been caused by the improper actions and instructions of a polygraphist who might have generated the negative attitude of the examinee towards the examination procedure.

The basic difference in resistance that distorts the record of the reaction is *intentional and deliberate* conduct of the examined person and the intentional purpose of these actions.

At present several ways of cheating a polygraph are known, divided into physical, intellectual, pharmacological, hypnosis, measures of mental autoregulation, communicative measures, etc.

It is necessary to emphasize that such classification is somewhat conditional,

since in practice the expert can face combined methods of resistance, and besides both intellectual methods and techniques of auto-regulation, hypnosis and communicative measures can be fully assigned to versions of psychological methods of resistance against a polygraph. Basically it is not important what measure or technique the examinee uses; it is much more important to be able to identify the fact of resistance.

Therefore, from a practical point of view it is useful to separate *professional* and *non-professional* resistance.

It is possible to speak about *professional* resistance when a person has had special training in the special services. It is possible to speak about opportunities for revealing this kind of resistance by trying to find small differences between parameters of natural reactions caused naturally or spontaneously. It is possible that such differences can be found, for example in one or other signals of brain activity upon registration of an encephalogram.

It is *non-professional* resistance when an involved examinee does not have *practical skills* of using one or another measure to try to cheat a polygraph (knowledge is not yet a skill).

Non-professional resistance can be *spontaneous* or *prepared*. In the latter case the examinee has information on ways of cheating a polygraph before the examination and chooses a certain tactic or measure of resistance for himself, but has no practical experience of how to apply these methods.

In cases of spontaneous resistance, the examinee does not have the information on ways of cheating a polygraph, has not prepared for resistance, and simply tries to do something during the examination. More often spontaneous resistance means trying to show excitement at answers to significant (control) stimulus in one or another way.

Non-professional resistance is quite often accompanied by its visible decoded features, both in behaviour and in registered physiological reactions.

"Paradox of resistance"

It is necessary to note the fact that those individuals who initially have a low psychosomatic limit are essentially more capable of applying mental measures to resist a polygraph screening that is demonstrated in them upon occurrence of expressed psychophysiological reactions at any increased attention or switching attention. The interrelation of a level of psychophysiological reactivity and ability to use measures of mental resistance can be called the "*paradox of resistance*", which can be formulated as follows:

"The better a person can switch attention to corresponding questions of the test, the greater abilities for mental resistance against a polygraph testing a person has".

The paradox of resistance can be demonstrated in a different way. For example, during a cognitive (stimulating) test (for example, with the name of the examinee), the worse a personal name becomes apparent in a row, i.e. the higher psychosomatic limit of occurrence of physiological reactions upon switching attention, the less capable of mental resistance a person is.

Complex approach to the problem of dealing with resistance

It is necessary to solve the problem of struggle against resistance not separately, but on the basis of a complex, systematic approach providing active struggle against resistance alongside actually revealed resistance. Use of a systematic approach to the problem of resistance means a simultaneous combination of the following factors:

- use of a set of various methods and means of revealing resistance
- application of a set of methodical measures reducing efficiency of resistance, even when it has been technically successful
- competent actions of a polygraphist on revealing applied measures of resistance and use of effective countermeasures against them.

For the purposes of coping with resistance experts should use two basic approaches in their work.

The first – to be able to reveal signs of resistance in a reaction record, behaviour and verbal answers of the examinee.

The second – to use various psychological measures that should help to complicate the application of the resistance method chosen by the examinee, and psychologically "break" his/her behavioural and tactical disposition, which are intended for struggling against a polygraph or a polygraphist.

In reaction records, non-professional resistance first of all is seen in signals of breath and motor activity ***irrespective of the used method***. Signs of resistance can also be observed in signals of arterial pressure or photopletysmogram (PP) as well as in a signal of galvanic skin response (GSR).

Computer methods of revealing resistance

For revealing deliberate resistance of an examinee, "Diana-02", the professional polygraph system specially developed for this purpose, can be used, which enables us to automatically conduct analyses of possible resistance level with indication of its relative value and type besides standard functions of the professional polygraph. For that purpose the system shall provide:

- analysis of speech signal parameters, with the purpose of revealing unprepared mental resistanceanalysis of the motor activity index of the examinee with the purpose of revealing physical resistance against the polygraph test screening
- revealing of atypical changes of breath of the examinee, with the purpose of revealing physical resistance against the polygraph test screening.

Use of Diana-02 provides for a fairly effective performance of a polygraphist in conditions of real resistance against a screening that accordingly leads to an increase in the reliability of results of the conducted test.

Diana-02 has now been successfully used in the Republic of Lithuania for both investigation of felonies and selecting employers for positions in a public service.

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You Can't Run, But You Can Hide: A Critical Look at the Fight or Flight Response in Psychophysiological Detection of Deception

In an earlier paper (Handler & Honts, 2008) we offered a theoretical explanation of the physiological changes observed in PDD testing. We noted that there were likely emotional and cognitive pathways that were involved in the production of observed PDD phenomena. The emotional pathway could be characterized as generally unconscious and automatic while the processes in the cognitive pathway were relatively more accessible to the consciousness of the subject. Our earlier work focused on the cognitive pathway. Here we would like to offer some theoretical speculations about the unconscious emotional automatic pathways suggesting conditioning may play a role in generation of arousal in the PDD context.

Fight, Flight or Freeze

Cannon (1927) described fear reactions as an overall sympathetic nervous system (SNS) arousal resulting behaviorally in what he called "fight or flight". When presented with an emergency situation, Cannon felt the animal can choose to fight the danger or attempt to flee. Fighting and running away both involve an initiation of movement, where immobility is just the opposite. However, as early as the 1970s Jeffrey Gray (1976) introduced the term Behavioral Inhibition System (BIS) to describe a series of responses to fear stimuli that include increases in arousal, behavioral inhibition, and increases in attention. Smith (2006) discussed fight or flight as an "active defense response" and freeze as a "passive defense response" to a perceived threat, and used telemetry to study the physiological responses of animals in the wild.

The "freeze" response became an integral part of Gray's early BIS hypothesis and described an inhibition of ongoing behavior. Updated descriptions of the BIS (Gray & McNaughton, 2003) discussed behavioral inhibition as decreased motor activity when presented with fear associated with an approach-based conflict. The updated theory separated pure "freeze" reactions from those that were behaviorally inhibited.

Gray and McNaughton (2003) noted freeze and behavioral inhibition were physiologically so similar as to make them very difficult to differentiate, especially in humans. The difference between the two in the causation of arousal was conceptualized as a difference between freezing proper and defensive quiescence. The freeze response (freeze proper) occurred when an animal was placed in the immediate proximity of a highly fearful stimulus, and was followed immediately by a fight or flight reaction. Additionally, this freezing proper was insensitive to anxiolytic (anti-anxiety) drugs. Behavior inhibition (defensive quiescence) was observed when the animal was forced into an approach-avoidance situation presumably resulting from the anxiety (fear) of a desire to interact with a potentially aversive stimulus and was *inhibited* by anxiolytics.

Gray and McNaughton (2003) observed that cases of conditioned "freezing" were found to be inhibited by anxiolytic drugs and are thus likely to be defensive quiescence that resulted from activation of the BIS. They observed defensive posture differences in rats that were freezing proper (freeze likely associated with fight, flight or freeze) and those that were engaged in defensive quiescence (freeze associated with BIS), They theorized the amygdala and septo-hippocampal structure interacted at higher sub-cortical levels in response to approach-based conflict.

Throughout this paper, when we discuss "anxiety" we are referring to "state anxiety", which can occur in milliseconds when an animal or human perceives an appropriate stimulus. The Oxford Dictionary of Psychology defines state anxiety as "A temporary form of anxiety related to a particular situation or condition that a person is currently in" (Coleman 2001). Clinicians may tend to use the word anxiety to refer either to "trait anxiety" (a tendency to a greater anxious reaction even if you are not anxious right now) or to chronic, and hence pathological, state anxiety. "Trait anxiety" is defined as "A person's general or characteristic level of anxiety." (Coleman 2001) We address anxiety in the tightly defined context of state anxiety. We will differentiate between extreme fear normally associated with fight or flight and mild fear that may accompany anxiety. Extreme fear is what one may feel when experiencing something that makes one want to run away. Mild fear or anxiety is what one is likely to feel when placed in an approach-avoidance situation where one is compelled to attend to a stimulus but do so with trepidation.

PDD examiners may be tempted to account for polygraph reactions using "fight, flight, or freeze" construct explanations. PDD examiners often cite situational examples in which the fight or flight response was activated during the pre-test interview to introduce the examinee to polygraph principles. The Defense Academy for Credibility Assessment (DACA), formerly the Department of Defense Polygraph Institute (DoDPI) *Anatomy and Physiology for the Forensic Psychophysiologist* chapter handout (DoDPI, 1994) states the reactions expected (or hoped for) during a polygraph examination result from fight, flight or freeze reactions.

These reactions include blood pressure (BP) increase, heart rate (HR) increase, an increase in the contractile force (CF) of the heart, a redistribution of blood in the body, increase in skin conductance (SC), a decrease in skin resistance (SR), dilation of the bronchi and *faster deeper breathing* (pages 47-48).

Responses commonly associated with fight or flight reactions include increased heart rate, increased blood pressure, increased muscle tension, increased contractile force in the heart, vasoconstriction in the blood vessels supplying the skin and viscera (except the heart and lungs), vasodilatation in the blood vessels supplying the skeletal muscles and brain, transformation of glycogen into glucose which is released into the bloodstream for energy, sympathetic impulses to the adrenal medulla to cause the release of epinephrine and norepinephrine into the bloodstream, reduction in digestive actions, increase in respiratory passageways and an *increase in the rate of respiration* (Cannon 1929; Tortora & Grabowski 1993; Rathus 2001).

However, BIS responses have been associated with an increase in blood pressure, a sensory orienting response and *decrease in respiratory activity* (Janig

2006, Fried & Grimaldi 1993). Bronchioles dilate, allowing more oxygen to enter the lungs with less movement. Slower and shallower breathing is thought not only to minimize movement, but to result in quieted system and focused attention to the surroundings. It may be safer for animals experiencing a threat to inhibit movement; crouch, wait, and hope to become more difficult to detect, while they assess the situation and deciding the best course of action. A reasonable conclusion is that the freeze response is either a genetically hardwired response (developed through evolution) or one acquired through association (Le Doux 1996). Animals who did not freeze when warned of an impending danger may not have survived. Freeze-type or BIS responses are accompanied by heightened arousal, awareness and alertness allowing risk assessment and preparation for action (Boucsein 1992, Boucsein & Backs 2008, Gray 1982, Gray 1987, Gray & McNaughton 2003).

According to Gray (1982), the BIS prepares the animal to better survive a potentially threatening encounter with a larger predator through more than simply reducing behavioral movement. There are a number of physiological changes that occur in anticipation of a potential negative encounter. This feed-forward type of physiological preparation is referred to by Peter Sterling and Joseph Eyer as *allostasis* (Sterling & Eyer 1988; Sterling 2004; Sapolsky 2004; Schulkin 2003). Allostasis is described as a centrally mediated, integrated brain-body response geared towards viability or survival. Imagine a rabbit feeding in a field that hears a noise it associates with a coyote. The rabbit has an appetitive desire to stay and eat, but this may conflict with the possibly aversive stimulus of the coyote. Bolting outright has some obvious potential disadvantages for the rabbit. The sound or movement of running may attract the coyote's attention or the rabbit may run closer to where the coyote is located surely reducing the chance of survival. On the fight side, the rabbit has only very limited options. Decreased behavioral activity and increased alertness serves to lower the rabbit's detection probability and maximize the sensitivity of its sensory systems. Increased blood pressure and muscular blood flow prepares the rabbit to flee or fight, but only if those responses are appropriate. All of these responses can be considered an allostatic change in preparation for a potentially threatening encounter.

Classical and Operant Conditioning

Classical conditioning involves an automatic response to an unconditioned stimulus. Early in the 20th century, Russian physiologist Ivan Pavlov (1927) studied digestive processes in dogs by giving them meat powder and then measuring salivation. Pavlov observed that over time his laboratory dogs

would begin to salivate before they were given the powder, a response that prepared the mouth for the dried powder. Saliva cleanses the mouth, dissolves the food so it may be better tasted, moistens food to allow compacting and contains enzymes that begin the chemical breakdown of food (Tortora & Grabowski 1994). Pavlov speculated that the dogs associated the appearance of the researcher with meat powder and the natural digestion process of salivation occurred because of the association. Pavlov went on to systematically pair neutral stimuli (for example a bell) with the subsequent presentation of meat powder and measured the salivary response. Pavlov called the meat powder an Unconditioned Stimulus (US), because it required no learning to produce salivation. Pavlov found that after pairing the ringing bell with the meat powder on several occasions, the ringing bell would elicit salivation without the presentation of meat powder. Pavlov called the ringing of the bell the Conditioned Stimulus (CS) and salivation the Conditioned Response (CR) because salivating to the sound of the bell was conditional on its temporal proximity to the meat powder.

Fear can be conditioned using the same classical conditioning procedures. Fear conditioning theory (Le Doux 1996) involves constructs of fear and anticipation, and applies the terms US, CS and CR in the same way as Pavlov's original experiment. Fear-conditioning experiments attempt to exploit unconditioned responses (UR) to better understand causes of arousal. A caged rat subjected to a painful foot-shock (US) generally responds with a great increase in activity directed towards escape from the situation, frantic jumping or scampering or by attacking something in the immediate vicinity (Gray 1982, 1987). If that shock is paired with a neutral stimulus (i.e. the sound of a bell) just prior to applying a foot-shock, the rat associates the shock with the bell (Le Doux 1996). A very interesting observation is the physical response to the bell once it has been paired with the shock. The bell (CS) causes immobility in the rat, a polar opposite of the physical response to the foot shock (US). Le Doux (1996) called the painful foot shock a "natural trigger" in that it requires no conditioning and is thus considered an US. The bell sound (CS) he called a "learned trigger" that becomes significant to the rat and warns of an impending shock (US). The rat is conditioned to respond to the sound of the bell because of the fear associated with the painful shock. This fear conditioning occurs quickly, is long lasting, and has obvious evolutionary benefits.

Where classical conditioning involved a pair of stimuli in an anticipatory learning context, operant conditioning allows for behavioral adjustment based on the consequences of the particular behavior. Operant behavioral conditioning (Rathus 2001) involves reinforcements and punishments and also the learning about the effects or results of particular behaviors.

Reinforcements are stimuli that encourage the continuance of a particular behavior (Rathus 2001) and can be either positive or negative as long as they encourage the subject to maintain that behavior as a result of their presentation, or omission, respectively. Harvard psychologist B.F. Skinner showed that a rat in a cage may be taught to repeatedly press a bar (Rathus 2001) by reinforcing the bar-pressing with food pellets (positive reinforcement). While food pellets are a desirable or positive reinforcement, that same rat would perceive a mild electrical shock to its feet as aversive and something it would like to avoid or mitigate. If the rat learns that pressing a bar stops the shock, it will press the bar repeatedly to avoid the unpleasant shock experience. The rat's behavior of pressing the bar is strengthened by the consequence of the stopping of the shock. This negative reinforcement occurs only after the rat has made the proper behavior choice.

Models of Arousal

There have been a number of models proposed to describe arousal and their neuropsychophysiological foundations. The Penguin Dictionary of Psychology (Reber, 1995) defines arousal as;

"A dimension of activity or readiness for activity based on the level of sensory excitability, glandular and hormonal levels and muscular readiness." (Page 54)

The terms "arousal" or "activation" have been used to describe intensity of behavior (Boucsein & Backs 2008). Arousal theories attempt to explain how the subsystems of the brain integrate to allocate resources directed to processing information and responding to stimuli. The Boucsein model (1992, also Boucsein & Backs 2008) divides arousal into four sub-systems and incorporates many of the features of earlier models including: the two-arousal system of Routtenberg (1968), the three-arousal systems of Pribram and McGuinness (1975) and Fowles (1980), the behavioral inhibition system of Gray (1982), the amygdala centered system (Le Doux 1996) and the circuits between basal ganglia and frontal cortex after De Long, Georgopoulos and Crutcher (1983).

In the Boucsein model (Boucsein 1992; Boucsein & Backs 2008), Arousal System 1 is referred to as the *affect arousal system* and is centered on the amygdala. The amygdala is considered to be one of the primary processes involved in the fight or flight response (Gray 1982, 1987) and the fight, flight or freeze response (Le Doux 1996, Boucsein & Backs 2008), and separate nuclei in the amygdala are arguably the main arousal component of anxiety. Cholinergic fibers originating in the reticular formation activate the affect arousal system via the amygdala that in turn activates the comparator system of the

hippocampus in the effort system resulting in increased focus and attention (Boucsein 1992; Boucsein & Backs 2008).

Arousal System 2 is centered on the hippocampus and is called the *effort system*. Gray (1982, 1987) and Gray and McNaughton (2003) proposed the septo-hippocampal stop system was responsible for the BIS and was the primary process involved in behavioral inhibition. The Boucsein *effort system* is not inconsistent with the BIS model in that they both ascribe primary responsibility for inhibition to the hippocampus and both are highly involved in arousal. If the subject perceives a potentially threatening stimulus, there is an increased flow of information to the hippocampus. Here a comparison process begins to assess the potential threat of the stimulus by comparing stored information to recently acquired information. That information is shared with parts of the brain that are involved in motor plans (the prefrontal cortex) and classically conditioned behavioral responses (via the basal ganglia in the cognitive loop). This comparator system does not interfere if the stored and incoming information match. If, however, there is discordance between the information, the BIS activates, resulting in motor inhibition, increased alertness, internal memory scanning and an increase in arousal.

Arousal System 3 is labeled the *preparatory activation system*, is centered on the basil ganglia system and is involved in somatomotor activity. When this system activates, it prepares the body for action by alerting the central nervous system processes involved in movement. If situational circumstances alert the *affect arousal system* (Arousal system 1) attention is shifted towards the alerting stimulus and this *preparatory activation system* prepares the body for movement. *Arousal system 2* (effort system) can block Arousal systems 1 (affect arousal system) and 3 (preparatory activation system) to prevent immediate movement. This disconnection is reflected in behavior inhibition that may be observed at the presentation of a stimulus associated with potential punishment or non-reward.

The fourth and final sub-system is Arousal System 4 and it is generally based around the Reticular Activation System (RAS) whose general function is to increase or decrease general arousal. This system is referred to as *general arousal system* and has a reciprocal relationship to the *effort system*. General arousal has the ability to inhibit motivational arousal (Boucsein & Backs 2008; Routtenberg, 1968).

Both the Boucsein (1992) and Gray (1982, 1987) models held that different parts of the brain were held responsible for mediating these two different reactions of fight or flight and behavioral inhibition. These models suggest that unconditioned aversive stimulus or non-reward US are processed largely in the amygdala, resulting in fight or flight behavior and conditioned fear stim-

uli that result in behavioral inhibition activate processes in the hippocampus. In the new model (Gray & Mc Naughtorn 2003) fight, flight or freeze and BIS were differentiated based on the context in which the stimulus is presented. If the situation were one that involved an all-out avoidance to potentially aversive stimuli, fight, flight or freeze is activated. If however, the subject is placed in an approach-avoidance dilemma, the BIS then activates.

It is clear that there are separate fear and anxiety processes in the amygdala (Le Doux 1996; Gray & McNaughton 2003). It is possible the hippocampus, particularly the ventral hippocampus (which has strong connections to the amygdala) contributes to *amygdala arousal* rather than controlling the decision aspects of anxiety. If this is the case, the hippocampus is still the controlling feature, and does so by acting on the amygdala.

Polygraph Test Questions and Conditioning

Relevant Questions

Earlier theories (Davis, 1961) suggested that consciously appreciated fear might have become a conditioned response associated with the relevant questions because of the fear and arousal experienced by the perpetrator at the time of the commission of the crime. Thus mentioning the crime in a question was a conditioned stimulus associated with the fear felt while engaging in the crime act. However, that view has been generally dismissed as at best incomplete and naďve, as some criminals may not be fearful during the criminal act and this explanation cannot apply to laboratory settings where no fear is involved in perpetrating the mock crime. Nevertheless, we propose that classical conditioning may well be involved in many PDD examinations, including laboratory studies, but different processes are involved.

People are social creatures and for the most part seek the approval and acceptance of their fellow humans (Ruch 1953, Rathus 2001). Most children are taught from an early age to equate honesty with honor and goodness. They learn that dishonesty is frowned upon and are often punished for lying. In most Western societies lying in formal settings such as in discussions with a person in a position of authority is frowned upon and in many cases such lying is punished severely when it is discovered (for example, lying to a federal law enforcement officer during the course of an investigation is a felony in itself.) Milgram (1963) suggests there is deal of potential anxiety associated with openly breaching such societal rules (Buck 1985).

In our view self-awareness of the act of lying can cause the test questions to function as the conditioned stimulus. Over the course of a lifetime the

fear, conflict and anxiety associated with lying may well in most, if not all, people have created a significant amount of conditioning. Just the possibility of getting caught in a lie and/or the punishment associated with being caught can generate anxiety. Thus even during an acquaintance test and/or in a laboratory setting (where there is little jeopardy) the act of lying may create substantial anxiety or conflict responses, and associated physiological sequelae. This is not to say that associated current consequences are without power or importance in any complete conceptualization of PDD. Clearly they are. However, their effect may be primarily in the cognitive pathway and may function independently, but additively with conditioning phenomena. Moreover, other cognitive processes are also likely to modulate these conditioning phenomena. Anticipation may certainly come into play, but most likely does so at a more conscious level.

During the testing phase of the polygraph examination the innocent person is not lying to the relevant questions of the examination, and thus the unconscious/emotional/conditioning pathway is not active. The innocent examinee generally wants to take the test to prove their innocence. There is no lying to the relevant questions and thus there is no unconscious conditioned fear response. This is not to say that the cognitive/conscious pathway may not be active as the examinee assesses the likelihood that the examiner will make an error and the consequences of such and error, only that a pathway to response that is likely active for the guilty is not present for the innocent. Also, there is no doubt that conscious anticipation of salient stimuli can exacerbate arousal.

The deceptive examinee is presented with (and has lied about) the relevant questions. They too have to attend to the test questions with the hope that they can pass the test. Both classes of examinee desire a "truthful" outcome, and both must accept the risk of approaching something (test questions) they probably prefer to avoid in order to achieve their hopeful truthful outcome.

Comparison Questions

In Probable Lie Comparison Question tests examinees are encouraged and led to believe that they must deny any transgression similar in nature to the one under investigation (Raskin & Honts 2002). The comparison questions in this case are broad in scope and encompass transgressions that most people would find impossible to honestly deny. The examinee is then led to believe that lying to these questions will result in their being considered a person who would engage in the type of activity under investigation. The innocent examinee has lied during the pre-test when denying comparison question type transgressions. They find themselves maneuvered into lying to the com-

parison questions in order to convince the examiner that they are not capable of engaging in behavior similar to the crime issue. For the innocent, this act of lying would trigger a conditioned fear response through classical conditioning processes. Activity in the cognitive/conscious channel will modulate this response as the person processes the memory necessary to assess the broad comparison questions. Lying to the comparison questions can cause arousal due to conflict, risk assessment, trepidation and anxiety about not passing the test.

For the guilty person, although the comparison question is responded to with a lie, the motivation and memorial context of the test is such that the relevant questions should present themselves as a much more powerful CS as they are central to the test outcome. In a sense this represents a discrimination problem in classical conditioning where a tone closer to the original tone used to establish conditioning will elicit a large, stronger and longer-lasting CR than will a tone more disparate from the original tone.

The Directed Lie Test (DLT) is a variant of comparison question PDD testing in which the examinee is instructed to lie regarding minor transgressions to the comparison questions (Raskin & Honts 2002). During DLT, the comparison questions may cause arousal through the same process of classical conditioning. We see no fundamental differences in the logic of why these two comparisons questions work.

General Discussion

We have presented information to suggest that the fight or flight response is not a satisfactory description of responses observed during polygraph testing. Scientific evidence suggests fight or flight behaviors and behavioral inhibition are mediated somewhat differently in the central nervous system, although there will be considerable overlap in their effects on autonomic output. Theoretically, fight, flight, and freeze reactions do not seem to represent a single construct, and appear to have distinct evolutionary bases.

General psychological theories suggest that we can consider the observable phenomena of response to test questions in the light of behavioral theories such as classical and operant conditioning, other theories involving emotions such as fear or anxiety, within the context of cognitive behavioral theory and also in neurophysiological theory. We would not recommend a simplistic adoption of any of these theories, but favor movement towards an integrative understanding of the role of each of these explanations when we seek to understand PDD phenomena.

In the light of conditioned response theory applied to PDD testing, it seems more likely that the test questions function as a conditioned stimulus than an unconditioned stimulus. Fight or flight responses are found to be activated in the face of an unconditioned fear stimulus, like pain inflicted by a predator. The BIS (freeze) response has been found to be associated with a CS, such as the light warning of an impending shock. When faced with stimuli that warn of impending danger it makes good adaptive sense to freeze and possibly escape the predator's attention. Importantly, the BIS is driven by the conflict created by activating the two systems of approach and avoidance. This conflict creates arousal via the hippocampus that either directly affects or contributes to anxiety in the amygdala. This is different from the traditional fight, flight or freeze paradigm.

The conceptual separation of fight or flight responses from freeze responses fits nicely with theories of different arousal systems (Boucsein & Backs 2008; Gray & McNaughton 2003). We have attempted to make a distinction between emotional and cognitive paths of arousal incorporating them into the "parallel path" conception from our earlier work (see Handler & Honts 2008). Whether arousal is reflected in different psychophysiological patterns by either of these branches has yet to be determined. There are physiological measurements (heart rate variability and EDA recovery times) that have shown promise in their ability to discriminate between a fight or flight (affect arousal system) response and a BIS (effort system) response (Boucsein & Backs 2008). It may be prudent to investigate these variables during PDD testing with an eye towards discriminating fight or flight from behavioral inhibition.

It may also be possible to exploit the phenomenon of habituation in an attempt to differentiate between areas of the brain controlling processing. Orienting is merely determined by the amygdala, while the hippocampus plays a major role in habituation (Boucsein, 1992). LeDoux's work with rats (1990, 1996) found that there was a "quick and dirty" neural link from the auditory pathway in the thalamus to the fear-controlling systems in the amygdala. He postulated that this immediate transmission served to get the rat's attention. The monosynaptic transmission did not transmit a great deal of information, but it sent a fast warning signal to the animal. The information bypassed the usual cortical-thalamic pathway that traditionally gives full meaning to the stimulus. This pre-attentive arousal has been linked to the orienting response (OR) and described as a high pass filter (Graham, 1997). Graham (1997) states that the purpose of the pre-attentive processing is to interrupt any current processing, initiate sensory intake and engage a protective gating that is postulated to prevent processing of weak stimuli. Once the animal's attention was aroused, it could conduct a more thorough neural investigation of the stimulus.

During PDD testing, this cortical-thalamic pathway would obviously play a role as the examinee would have to process and recognize the test question. It is unlikely that Le Doux's "low road" of direct connection from the auditory thalamus to the amygdala is what causes arousal during polygraph testing. Examinees hear the question and process the meaning. This processing often occurs before we finish speaking the question, but generally incurs some latency while the examinee recognizes the stimulus. If the examinee has lied during the pre-test interview and question review, the presentation of the stimulus and the recognition of the act of lying can create the CR. Indeed it is not even necessary for the examinee to utter the lie during the polygraph, as has been demonstrated by the "silent answer" variant of test question presentation. Truthful and deceptive examinees can produce reactions to test questions which they have lied about (without necessarily responding verbally) through classical conditioning.

We submit that there are a number of potential causes for arousal during PDD testing – some functioning consciously, others subconsciously. In our earlier work (Handler & Honts 2008) we started to clarify our understanding of arousal observed during PDD testing. We began by analyzing work from other disciplines that could help shed light and continue to explore areas outside of the polygraph for our answers. In this paper we examined the work of scientists in those sister disciplines that closely relate to the polygraph.

Our first goal in this paper was to submit that the act of lying, either explicitly during the test or implicitly during the question review, can function as a CS. We suggest that this CS occurs unconsciously and automatically and is related to emotion associated with the act of lying (fear, guilt, embarrassment, conflict, anxiety etc.) Our second goal was to review the work of neurobiologists and psychologists in search of theories that relate to arousal observed during PDD testing. We believe that we found examples of such theories in the work of Gray (1982, 1987), Gray and McNaughton (2003), Boucsein (1992), Boucsein and Backs (2008) and Le Doux (1996). A number of the physiological and psychological aspects of the effort system (Boucsein & Backs, 2008) or BIS (Gray and McNaughton) seem highly congruent with those of PDD testing. In both of those arousal theories, arousal to CS and to US is mediated differently by the brain. The amygdala is generally held responsible for fight or flight responses, while the effort system or BIS include the hippocampus.

While we continue to lack a higher and purely psychological explanation for PDD responses, we are not alone. Other branches of behavioral science are faced with the same challenge and shortcoming in their ability to clearly delineate higher level processes. Psychophysiology is particularly impoverished

in theoretical development. Years ago when the polygraph profession sought an explanation for what was measured, they embraced the current scientific knowledge and conjecture of the time. We have attempted take advantage of the advances made in neighboring scientific disciplines that directly relate to PDD and offer the capability of enhancing our understanding of the psychological and physiological basis for observable responses to PDD test stimuli. It is through a continued search for the most parsimonious psychophysiological explanations that we will solidify our understanding of the construct validity of PDD testing.

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The Event Knowledge Test (EKT) in Polygraph Examination (common notice of tactics)

We have already described how we developed an idea to create the EKT (Saldžiūnas, Kovalenko, 2008). We have also described how we managed to help the police to investigate a homicide using the EKT (Saldžiūnas, Kovalenko, 2008). We would now like to offer for your consideration the tactics that we use in constructing questions and answers while using EKT-related methods. We would like to say directly that this has been proven by our practice. Yet we think that other ways of solution are also possible.

By using EKT methods, we have made sure that the result of a psychophysiological investigation using a polygraph highly depends on the sequence

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in which the questions are arranged and on the answers that are selected. V. Varlamov (1998) states that the success of a psychophysiological investigation while working with modern polygraphs depends 99% on the quality of the questionnaires prepared.

The Krasnodar (Varlamov, Varlamov, 2000) Polygraph School suggests starting a crime or offence investigation with search tests in order to become oriented in the criminal history of the person being investigated. They further propose conducting "indirect" tests, i.e. the GKT. It is suggested that psychophysiological investigation using the polygraph finish with a comparative question test. Resting on our own experience, we think that a single question related to criminal experiences cannot lead towards absolute clarity. This kind of question may only generate a series of explanatory questions, and a psychophysiological investigation may shift to a different direction, and not the one formulated in the task by the initiator of the investigation. It is most often totally purposeless to expand a definite investigation for the sake of achieving concreteness of the investigation itself, for a limited number of auditions and the period of investigation.

S. Oglobin and A. Molchanov (2004) propose a different sequence of auditioning. They suggest starting a psychophysiological investigation with the stimulatory test followed by a control test, three examination tests and finishing with a control test.

While investigating criminal events, we would like to propose arranging the questions provided in the EKT test with regard to the following principles:

1. It is desirable that the first and often the second question should not be directly related to the event under investigation. It is usually the kind of suspects who agree to be investigated using a polygraph who are not guilty of a crime, as it turns out from the investigation. The said suspects are usually being investigated using a polygraph for the first time. They are highly afraid of the aforementioned procedure. In order to diminish their emotional tension, it is obligatory that they get used to the sensors and emotional tension, as well as the equipment itself (polygraph), and make sure that the polygraphologist has told the the truth about the polygraph being "not frightening" and that no provocations take place. Polish polygraphers have indicated that there have been cases when suspects who have committed a crime according to the data of later investigations, having signed the agreements to perform psychophysiological investigations, foresee later additional threats and may refuse to take part in an investigation as late as during the phase of investigation. Bearing in mind the first issue, the objective is to "hush" the investigated person's vigilance and to diminish his/her emotional tension. Therefore, the answers to the questions they are given are most often selected inasmuch as

they are not related with their past criminal activities (regarding the results of the investigation) or are totally neutral to the person being investigated. The opposing polygraphologists (Matte, 1997; Raskin, Honts, 2002; Handler, Nelson, 2008) may state that a stimulatory question is obligatory. It might be a specific characteristic of our region, but we have not yet encountered a person unable to invoke organism reactions using a modern polygraph by providing important questions during a psychophysiological investigation. We know from theory that people might exist who have a different kind of psychophysiological composition, and whose psychophysiological reactions are much more complicated or impossible to invoke. For the said reasons, the tactics we offer are obviously not universal.

2. Questions are arranged in a sequence whereby social significance increase while they are formulated. Here, social significance is not a subjective matter: the polygraphologist and the suspect may evaluate it in different ways. Therefore, polygraphologists may make errors. We investigated a case of a homicide performed a few years before. The suspect investigated was concerned more about the fact that the police may find out the information that the leader of the gang had planned the crime rather than in the fact that it may discover the details of the homicide. The Krasnodar polygraphologist N. Nikolayeva said that one of the suspects she investigated did not manifest any psychophysiological reactions related to a question about killing his wife. It turned out later that he treated his crime as a punishment rather than a homicide. Therefore, we suggest that questions intended for a potential criminal be arranged regarding the growing tension. In our opinion, a suspect may not react any more towards less socially significant questions after a question that is highly socially significant to him/her. In such a case, other necessary questions regarding the event would not be clarified during psychophysiological investigation. Meanwhile, such an arrangement of questions has no essential significance to a suspect not involved in the crime investigated. Experience indicates that such suspects that possess non-unbalanced minds adapt after a number of introductory questions and that their balancing curves gain stability.

3. Whatever principle of investigation is used (deductive or inductive), avoiding consistency is recommended. Although suspects being investigated usually have not developed analytical thinking, educated and sensible suspects are also sometimes encountered. In order to make them misunderstand in what direction the investigation is shifted and not refuse further investigation, it is better to interchange some of the questions with identical social meanings.

4. The question with the highest social significance or importance must go last. This is a consequence of the information we provided beforehand.

5. We recommend that every question be written on an individual paper strip while constructing the questionnaire. Afterwards, interchanging the strips containing the questions is easy when searching for the best question arrangement until the optimal version is found.

In a test similar to EKT, Japanese writers (Nakayama, 2006) recommend using questions on the crime scene, how the criminal action was planned, and what items were acquired. They do not recommend asking questions about colours, amounts of money, the number of crimes, or the date and time of the crime. They also make use of photographs, building blueprints, maps and real items in their questions. We do not fully agree that questions about colours and different numbers should not be asked. We have also confirmed that suspects do not memorise colours and numbers well in all cases. Every case requires an individual approach to questions. We have successfully employed questions related to the colour of a car and the colour of a raped and murdered girl's underwear. We noticed that suspects memorise numbers to a different extent. The majority of suspects memorise approximate amounts of money. It is hardly believable that suspects would memorise the exact time of a crime or the code of a bank vault after a lengthy period. S. Abrams (1989) describes employment of information on amounts of money in questions. J. A. Matte (1997) also states that numbers could be asked about. Additionally, we would like to point out that the way the variations of answers are provided to the questions is also significant. Matte provides strongbox code variations for the suspect having grouped the numbers into pairs, e.g. 9 – 48 – 13. We have learned through practice that having provided a suspect with only one variety of strongbox code, sufficient psychophysiological reactions may not be detected, as the suspect has memorised the code in a totally different way. During an investigation of theft from a bank vault, we provided the suspect with a question on a bank vault code twice. We provided the answers to the first question using detached numbers: 1 – 2 – 3 – 6, 7 – 4 – 1 – 2, etc. We represented the codes graphically for the second question (Figure 1).

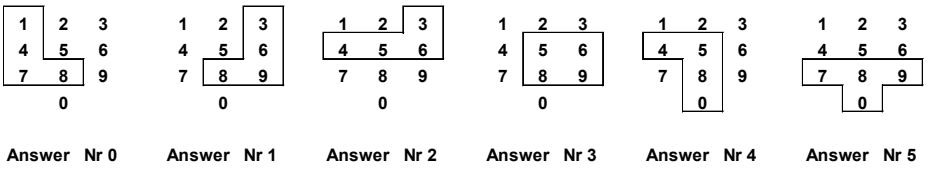

Figure 1. Varieties of bank vault codes

Significant psychophysiological reactions of the suspect to the answers of the first question were not detected. Meanwhile, a conspicuous psychophysiological reaction to one answer of the second question was detected. Therefore, in our opinion, creativity is necessary when preparing questions and answers. In case no significant psychophysiological reactions are obtained after polygraph examinations, performing an analysis is necessary to find out why reactions have been absent. The answers might have been provided in a wrong form. The sequence of the answers should be considered carefully: e.g. …3. counterfeit money, …5. money. If the third and the fifth answers are interchanged, the suspect might react to both answers, in case counterfeit money had been taken. It is possible to find more answers, too. It is crucial to consider carefully which answer should be provided first: "debt" or "shortage of money". Personal names should be chosen with care. Similar names should be avoided, and even names starting with the same letter as the suspect's name. It is mandatory to ascertain whether the suspect has several names.

The Russian polygraphologist J. Cholodnyi expressed the opinion during a discussion that the answers should be arranged in a closed cycle, i.e. the list should be finished with "other persons" in case names of persons to be identified are enumerated. This could be applied when enumerating crimes, cities, weapons, etc. E. Lewandowski and L. Lewandowski (2008) also apply a closed character of sequence in tests. We have not yet clarified in our investigations whether this gives a result. In our opinion, since formulation of the answer is not specific and has a general character, the suspect does not experience a high level of stress, and psychophysiological reactions of insufficient strength are detected. We have found that low-intellect subjects do not understand such answers.

In some cases, it is totally purposeless for tactical reasons to finish a sequence with such a general answer. Afterwards, curves are sometimes obtained having enumerated all the answers forecast by investigators (Figure 2). Figure 2 indicates two versions of how the suspect's general psychophysiological reaction calculated using the ChanceCalc algorithm (Sochnikov, Pelenicin, 2006) may change after every subsequent answer.

In the first case, the suspect's psychophysiological reactions decrease significantly after several answers have been given, yet they retain a level that is not very high: in this case probably the suspect is innocent. In the second case, the suspect's psychophysical reactions constantly increase with every answer. Yet when such changes in psychophysiological reactions are detected, one can state that the answers provided do not contain the real answer related to the event. The suspect has "anticipated" and missed the "dangerous" answer. Dilts R. (1999) states, quoting M. Makluchan, that the way information is received and conceived has a greater impact than the information itself. We

have also found out that exposing real instruments of the crime to a suspect is much more efficient than showing their photographs and even more efficient than describing them in words. In a few of our investigations, we exposed photographs to the suspect with a live model dressed in the similar way as the victim in different positions rather than describing the place and pose of the dead body left by criminals. Using a polygraph, we detected very strong psychophysiological reactions caused by stress.

We would like to point out the certain specific circumstances when the suspect is provided with answers in the form of showing a map of a location divided into sectors. Every sector is assigned a number (Figure 3). If the suspect is the criminal and knows according to the map in which sector the instrument of the crime or victim's body is hidden, and sees the sequence of numbers provided, a polygraph detects strong psychophysiological reactions before showing the necessary sector. For this reason, computer-based algorithms are not applied for calculating reactions.

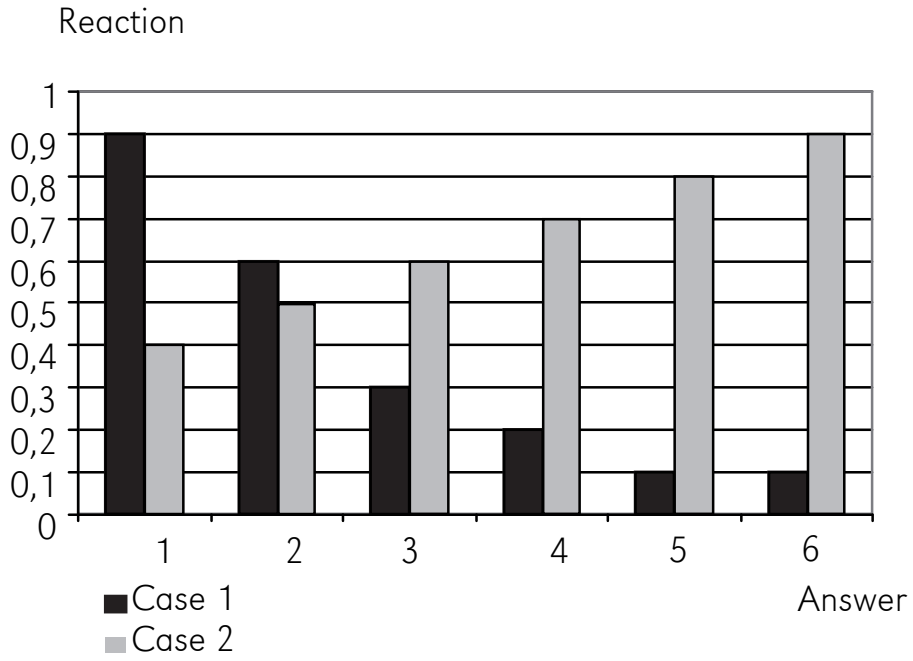

Figure 2. General psychophysiological reaction in a sequence of answers to one question.

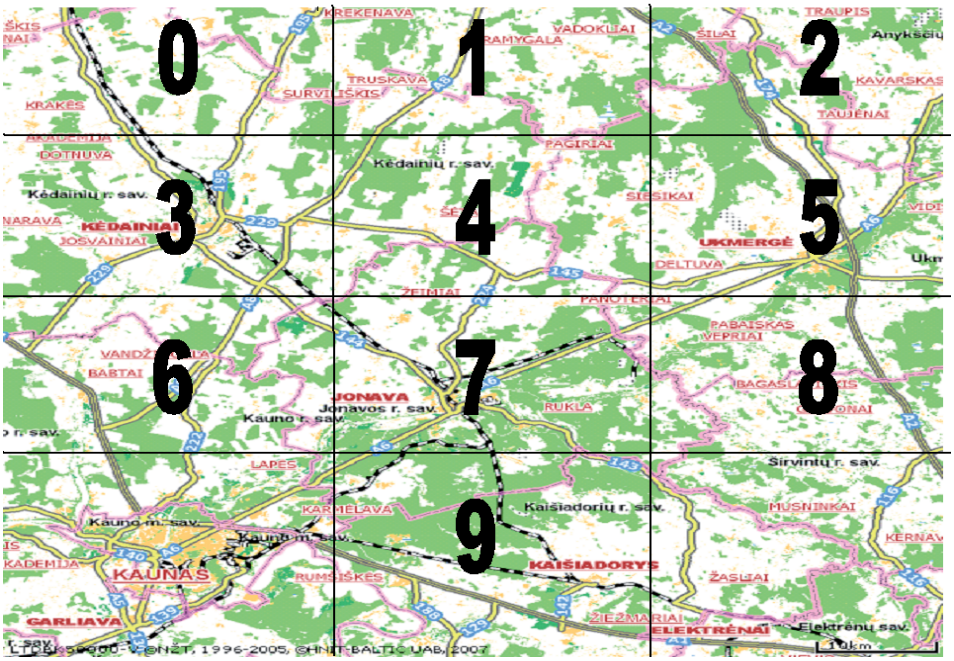

Figure 3. An example of map division into sectors.

For the sake of evidence, in order to demonstrate how we apply some of the principles mentioned here in practice, we present a description of a recent investigation.

In March 2008, a vehicle was stolen from a garage of a state institution. The car was driven out past a security post and its absence noted only after several days. Video recordings were examined, and the way the thief operated was determined. Unfortunately, the recording was taken from a considerable distance, and identifying the thief's face was complicated. According to the thief's actions it was possible to draw conclusions that he knew where he was going in the garage territory, acted in no hurry and with certainty. The police started to investigate the event. A hypothesis was made that the thief was instructed or informed otherwise by a person working or having worked before at the institution.

Police informants indicated a number of persons who could potentially have stolen the vehicle. They were questioned. It was a great success, as one of them was highly similar to the person captured in the video recording. This person, citizen S., told the entire story with no great resistance.

He was walking past a supermarket in the middle of March this year. He wanted to purchase some beer but was short of a few cents, which he at-

tempted to beg from shoppers. When he asked a man passing by (it was later determined by way of detection from the reflection of a mirrored glass that he was citizen V.) to give him 50 cents,V. said to him, "Why beg for money here? I can give you a chance to earn it". Citizen V. gave citizen S. 2 litas and indicated that a vehicle should be stolen, driven towards Žalieji Ežerai Lake District and left there. V. said he would give 500 litas for the job. S. agreed to steal the vehicle, as he needed money. V. said that he should arrive the next day at half past seven in the morning at the address provided. The next day, S. arrived at the indicated spot at the appointed time, where he met V. He took S. to the courtyard of some house and pointed to a nearby high white fence. V. indicated that S. had to climb the fence at the moment, bypass the security post, climb onto the roof of the garage extension, jump from it onto the nearby vehicle and find the dark blue VW Vento vehicle with tinted windows. V. indicated that the vehicle would not be locked and the keys would be inside the glove compartment. S. had to approach the gate in the vehicle, briefly press the sound signal button, and then the guard would open the gate. In the period between 6 pm and 7 pm he had to drive the vehicle to the parking lot next to Žalieji Ežerai lakes. V. instructed S. to leave the keys inside the vehicle. V. gave him 50 litas and asked where S. lived; the answer was Saracėnai Street. He promised to bring the remainder of the amount to S.'s home.

After giving evidence related to detection in the police station, V. recognised S., and V. was consequently arrested. V. did not admit participation in committing the crime and claimed that he did not even know S. The necessity arose to test V.'s claims using a polygraph and to detect whether the suspicion related to V.'s involvement in the said crime was motivated. V. agreed that his statements be investigated by way of psychophysiological investigation using a polygraph.

It is interesting that the specialists involved in this definite psychophysiological investigation using a polygraph knew V. in person before the investigation as a respectable person. It sounded unbelievable to them how he could commit such actions and be involved in the said crime. A hypothesis was made that very serious family-related or other reasons must have encouraged V. if he had dared take such a step. On the basis of material available as well as presuppositions (version), questions and answers were constructed based on EKT (Saldžiūnas, Kovalenko, 2008).

1. What addictions do you have?

0. smoking
1. use of drugs
2. alcohol abuse
3. gambling in casinos

4. having a mistress
5. behaving violently with animals.

2. What actions have you committed this year for which you could be punished by the police?
0. counterfeited money
1. beaten your wife
2. stolen gasoline
3. counterfeited a signature
4. illegally appropriated vehicle parts belonging to the garage
5. injured a person in a vehicle accident.

3. How long before the vehicle theft was the territory of the institutional garage shown to the thief?
0. 5 days
1. 4 days
2. 3 days
3. 2 days
4. 1 day
5. on the day of theft – R (author's note: R – relevant answer).

4. Why did you agree to help to steal the vehicle?
0. for the very idea
1. wife ordered it
2. had some debt
3. "tempted by the devil"
4. desperately needed money
5. blackmailed
6. mistress suggested it.

5. How many litas did you give the thief for stealing the car?
0. 300 litas
1. 200 litas
2. 100 litas
3. 50 litas – R
4. 20 litas.

6. Where did the thief have to deliver the stolen vehicle?
0. next to the stadium

1. next to the garage territory
2. to Naujininkai District
3. next to Žalieji Ežerai Lakes – R
4. next to Kauno Marios
5. to Pašilaičiai District.

7. Who stole the vehicle? photographs of 6 persons are shown/ (third photograph – R).

8. On which street does the vehicle thief live?
0. Žalgirio
1. Apkasų
2. Kalvarijų
3. Saracėnų – R
4. Upės
5. Žvejų.

The first two questions are introductory. They are intended to calm down suspects who are not related to the event. On the other hand, the two questions serve the function of partial probing of potential causes. We state that they serve partially, as they certainly do not embrace all possible life situations. We might have been successful, or the situational forecast may have been good, but we were well-directed. We did not include a question on the amount promised as a reward (500 litas). In our opinion, the number of good questions was sufficient. The most powerful questions are number 7 and number 8. Question 7 is slightly less powerful than question 8, as citizen V. changed the evidence he provided throughout the questioning procedure at the police office. He had already provided the version that he had accidentally seen citizen S. near the supermarket.
The following significant reactions were detected during polygraph examination: question 1 – answer 4; 2 –5; 3 – 5; 4 – 2 and 4; 5 – 3; 6 – 3; 7 – 3; 8 – 3. We could draw the conclusion that citizen V. had psychophysiological reactions typical of a person who is aware of the circumstances/details of a theft. As five questions are directly related to the theft, the chance that V. was involved in the crime is approximately 99.9% (Saldžiūnas and Kovalenko, 2008). Additionally, based on psychophysiological reactions, a hypothesis can be made that V. had caused a vehicle accident and was indebted to someone. This could trigger V.'s involvement in the theft, as, according to our data, he had no savings. At present, the criminal case where S. and V. are suspected for committing the said crime is undergoing a lawsuit investigation.

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Magdalena Zagdan*

Academic Seminar "The Usage of the Polygraph in Criminal Examination as well as in the Psychophysiological Testing of Staff"

Conference Report

An academic conference entitled "The Usage of the Polygraph in Criminal Examination as well as in the Psychophysiological Testing of Staff" took place in Szczytno on 12th and 13th June 2008, organised by the Szczytno Police Academy.

The meeting saw the participation of representatives of the academic community as well as those who utilise polygraph research for the purposes of the police, border guards, military police and other services. The proceedings of the first day were coordinated by Jerzy Konieczny, while this was performed on day two by Rafał Kwasiński. The words of introduction and invitation for comments on papers given, following the Police Academy's Rector's welcome, were given by Magdalena Zubańska of the Szczytno Police Academy.

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First to appear was Łucjan Wiśniewski, with a few comments about the use of the polygraph in criminal and staff cases. He also recalled the history of the development of polygraph research in Poland, especially the pioneering work of Professor Horoszowski and Aleksandr Krzyścin. The talk was given variety by the inclusion of several interesting criminal cases which were of a breakthrough nature for Polish practice; cases in which polygraph research was applied and in which the speaker had personally had the opportunity to participate.

Michał Lisowski of the Central Criminal Laboratory of the Central Police Command presented a paper entitled "Polygraphic Criminal Research in Poland", in which issues relating to the polygraph were discussed from a practical point of view. He presented the course of polygraph research while at the same time discussing the equipment used for the Laboratory's purposes, and also drew attention to the research methods employed in particular guilty knowledge tests and direct lie tests. Lisowski presented in a statistical depiction the number of tests conducted by the Laboratory for the period 2002 to 2008. During this time frame 344 tests were commissioned, of which 246 were carried out: for court purposes 19; for the Public Prosecutor's Office 149, and for the police 177. In the current year the Central Criminal Laboratory has carried out 33 polygraph tests.

Other speakers included Ewa Rzeczek and Cezary Jaworski from the Staff and Training Office of the Central Police Command. They presented jointly the topic of "The Legal Bases for the Conducting of Psychophysiological Testing in Poland", basing their presentation on the current legal regulations concerning the question in hand. Fragments of the Police Act and its executive directives were discussed, and mention was also made of internal acts, for example: on the management of the main police command concerning the practical side of tests, as well as the organization of the team for psychophysiological research containing a register of service positions at which tests can be carried out. There was also mention of the legal regulations on the scope of testing itself and the preparation of documentation of the acts carried out.

There were two subsequent parts to the conference. Igor Szczupak's very concise presentation of rudimentary practices in the field of polygraph testing dealt with matters of cooperation between the party commissioning the testing and the people conducting the tests themselves. The paper drew attention to the fact that appropriate cooperation between the parties involved allows for a far more accurate question selection as well as ensuring the most appropriate choice of test. The speaker also touched on the problem of maintaining secrecy in relation to test results.

Ilona Klonowska-Senderska of the Police Training Centre in Legionów presented a paper entitled "The Polygraph as an Element in Selected Staff Placement Selection". Here she dealt with an attempt at analysis of the current situation of staff testing in the police, both in the planning stage and awaiting implementation. Klonowska-Senderska discussed how the programme of training actually looks for those who in the future are to undertake staff testing for police requirements. She proposed changes in the regulations including the abolition of polygraph testing's being optional. Equally she advanced the idea of the creation of a discussion panel of the individuals carrying out the tests including discussion with psychologists with the aim of enhancing the interpretation of polygraph testing.

Professor Jerzy Konieczny's (*Andrzej Frycz Modrzewski University College*) paper dealt with modern methods of polygraph interpretation. In addition he dealt with matters that are innovative in the field of polygraph research. He talked about the question of pre-testing interviews as a structured interview constituting a diagnostic element of the test. Additionally, Konieczny characterised polygraph testing as a two-tiered test through its division into a screening test and a diagnostic test. He equally drew attention to the relatively low reliability of screening tests, as well as to the possibility of the view of the honesty of the person tested within the test resulting from them. At the same time, however, he noted that the application of this type of tests reduces the risk of obtaining so-called 'false negative' results. In an additional two-stage division he mentioned equally diagnostic tests including Utah ZCT, PLT, and Federal ZOC.

The final paper was that of Piotr Sukiennik of the military police, who presented the current state of polygraph research in his service. The speaker postulated, as an introduction, several concrete changes in the proposed regulation on staff testing in the police. He presented, generally speaking, the pragmatics of the polygraph research carried out for military police needs.

The final part within the conference's first day was the organisation of a panel discussion in two groups. The first, chaired by Łucjan Wiśniewski, concerned psychophysiological staff testing. The discussion attracted chiefly those connected with the police and other service circles, interested in the work and substantive discussion of plans to introduce staff testing in the police.

The second discussion panel concentrated on the utilisation of polygraph testing in criminal testing. The moderator was Michał Lisowski, who direct-

ed the discussion in relation to an exchange of experience and views on the subject of the practical application of polygraph testing in criminal practice.

The second day of the conference was initiated by a presentation given by a delegation from the Republic of Lithuania, headed by Jonas Gibavičius, who presented to those assembled the computer polygraph "Diana", produced by the Meldeta Company. The innovative features of the model include a system for the intelligent setting of the program and the mounting of a so-called 'stress gauge'. It has also been equipped with a so-called 'lens mode', allowing for the enlargement of any fragment of a polygraph.

Edward Lewandowski was the next speaker, his subject being "The Efficiency factors of Psychophysiological Criminal and Staff Testing". His detailed and far-reaching paper included questions troublesome for polygraph testing in Polish conditions. He drew attention to the necessity to constantly raise the qualifications of those carrying out tests, proposing the creation of an expert code of ethics. He postulated the creation of the possibilities of a quality control for tests by other experts as well as the introduction of standards for polygraph testing in accordance with the European Standards of Competency.

Valdas Saldžiūnas of the Lithuanian Ministry of Internal Affairs gave a paper entitled "Tests of the Knowledge of Occurrence in Lithuanian Practice". Here he raised problematic questions with which the application of testing has to cope in Lithuania. The most interesting to note are those situations in which Lithuanian courts do not understand the concept of 'lying'. The police know of too few details upon which to construct the testing and the individual tested has difficulty in understanding the meaning of the questions of the sacrificed relevant type. By applying the Guilty Knowledge Test or Peak Of Tension Test, the questions are formulated in such a way so as to be indirect and subsequently to avoid being accusing in character. Lithuanian practitioners work in close cooperation with other services, classifying their own mistakes with the aim of raising quality.

The next speaker was Marek Abramowicz of the Regional Police Command in Krakow, who dealt with the subject of using polygraph testing in (under)cover operations. He touched on the question of using polygraph testing within the framework of operational-investigative work which is not clearly cited within the Police Act as permissible. He revealed, however, that operational experts as well as appointed consultants carry out testing within the framework of operational matters, in the case of crown witnesses (individuals applying for

such status or those during the process of protection programmes) as well as candidates for work in HUMINT.

At the end of the conference Piotr Herbowski of the Police Academy in Piła presented the matter of the detector's usefulness of testing technology in polygraph testing, while Rafał Kwasiński and Mirosław Tokarski of the Higher Police Academy in Szczytno discussed the influence of the results of polygraph testing on the effectiveness of the detecting process.

Final reflections

The talks ended in a discussion summing up the two-day academic conference. As this was the third academic conference in a row to deal with such matters it was put forward that annual conferences should be organised to broaden the exchange of views and experience that would enhance the knowledge of experts by the practical experience of other services.
Poland has a tradition of polygraph testing which goes back decades. This conference showed that in certain aspects testing is conducted at a high level which incorporates the latest global achievements. There are, however, some areas where Polish specialists still have a lot to do – these concern, for example, the question of guaranteeing and control of the quality of testing. These matters were not, unfortunately, touched on by any of the papers given.

Book reviews

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Psychology and Law. Bridging the Gap

edited by David Canter & Rita Žukauskiene, Ashgate Publishing Co.
Hampshire–Burlington 2008

This book is a collection of articles by various authors, focusing especially on investigative psychology, including profiling, as well as court psychology.
The very title of the book suggests that there is a gap between psychology and law. Moreover, this gap is broadening with the passage of years, parallel to the progress of knowledge. Lawyers, and especially law practitioners, not only fail to keep up with that progress, but do not even try to do so. Even elementary psychological knowledge is unfortunately alien to the majority of judges and prosecutors. Thus all attempts to build bridges between psychology and law are welcome; the problem is there being anyone to use the bridge and cross it.
This review focuses on the article by Ewout H. Meijer and Peter J. van Koppen "Lie Detectors and the Law: The Use of the Polygraph in Europe". The authors are Dutch psychologists working at Maastricht University. Meijer's primary area of expertise is psychophysiological detection of deception in various settings. Van Koppen is senior chief researcher at the Netherlands Institute for the Study of Crime and Law Enforcement, Leiden, and is also serving as president of the European Association for Psychology and Law.
The text begins with a presentation of the current situation in Belgium, which has the broadest application of the polygraph in Western Europe. The Belgian police began to use the polygraph in the 1990s, and currently approximately 300 polygraph tests are conducted there every year. The authors believe that the success of the polygraph in Belgium to a great extent results from the fact

that a certain number of suspects admit to crimes during tests or immediately after them.
The Belgian practice was presented somewhat differently by Dehon (Dehon 2006), who not only considers the number of polygraph tests conducted by the Belgian police to be greater, but more importantly believes their efficiency to be higher too.
The authors then move to the discussion of the polygraph test itself, presenting the basic types of test techniques: the Control Question Test (CQT) and the technique based on the Guilty Knowledge Test (GKT), discussing in detail the validity and accuracy of the tests performed in the control question technique as described by various authors. The data were verified in 2003, when the National Research Council reviewed the literature on the accuracy of polygraph examination based on CQT. Performing an earlier selection of cases from the point of view of methodological validity, the council reviewed 37 selected works based on experimental laboratory research and 7 works evaluating accuracy of polygraph examinations in field studies, defining the accuracy index from 0.85 to 0.89, which is tantamount to an accuracy rate of approximately 80%.
On these grounds, the National Research Council maintained that the distinction between lying and truth is far above chance, yet at the same time far below perfection. A separate question discussed in the article is the use of polygraph tests (in the CQT version) for testing sex offenders. Although not free from criticism, polygraph tests in this category of crime are even accepted in certain states, where polygraph tests are not generally applied in investigations.
The problem of ambiguous results is presented on the grounds of two Belgian case studies of murder cases.
Subsequently, the authors discuss the Guilty Knowledge technique, which they derive from Munsterberg (1908), and which owes its name to Lykken (1960). This testing technique is safer for innocent suspects. The probability that an innocent suspect will react randomly to the critical question in five successive tests with live alternatives is 0.03%. This would seem to be the decisive factor making the GKT technique better than control questions. It is, however, to be remembered that GKT can be used only in the first phase of police investigation, and also that there are sometimes problems with proper design of multiple tests for a single case.
The authors believe that this technique of polygraph tests is used more commonly only in Japan, where approximately 5000 such tests are performed every year.
Is use of the polygraph in Europe, the authors note a major variation. Primarily, we are dealing with two systems. In the first, the final evaluation of

evidence is governed by the conviction in time: the court convicts when it is convinced the suspect is guilty. In the other, the court must argue its verdict in a manner that conforms to certain statutory standards, which, however, tend to be rather lenient. According to the authors, typically in this systems an appeal to the Supreme Courts can only concern matters of law, not the manner in which evidence was considered by the lower court. This may explain, therefore, why in some European countries, in spite of a policy or precedents that forbid the use of polygraph tests as evidence, they are nevertheless used. Discussing the practice of resorting to polygraph testing in various European countries, the authors remind us that over 300 tests are performed every year in Belgium using the CQT technique. Introducing the polygraph into police practice, it was assumed that tests would not be used beyond police investigations and that results would not be offered as evidence in court. Nevertheless, the practice went further, and actually such evidence has already been accepted by courts.

In the Netherlands, the polygraph is not used either in police investigations, or – especially so – as evidence before the court. This kind of evidence was rejected by the Hague Appellate Court, whose decision was upheld by the Dutch Supreme Court (18 June 2004, LJN AU 5496). The Supreme Court argued, that "the use of polygraphs in criminal investigations is disputed because of its unreliability". On the other hand, the polygraph is used in the Netherlands in sex offender management. There have been attempts to use it in criminal cases in the United Kingdom. However, the report by the British Psychological Society of 2004 concluded that "the use of the polygraph has inherent weaknesses, and the error rates can be high". In the United Kingdom, too, the polygraph is used in sex offender management; the UK is a pioneer in putting the polygraph to such use.

In Germany, the Supreme Court once again abandoned the CQT from procedure in 1998. Despite this the polygraph is used in Germany in civil cases, mainly child custody disputes with allegations of sexual abuse of children.

In Finland, the polygraph has been used by the Finnish National Bureau of Investigation since 1995. Approximately 300 tests were performed, mostly in the case of homicides and sexual crimes. The GTK technique was also used in murder cases to disclose the place where the corpse was hidden.

In Norway, the polygraph is used by the police in the pre-trial phase, with the courts treating such evidence in various ways. In 1996, the Supreme Court rejected such evidence, yet later similar evidence was accepted by Appellate Court. In the 1990s, the polygraph was used two or three times in Sweden. The result of the test was presented to the court by the defence in child sexual

abuse cases as a proof of the defendant's innocence. The court allowed the evidence, but finally gave it low weighting.

In Switzerland, the polygraph is considered an unlawful means of investigation: according to the Swiss courts, polygraph testing violates Art. 6 of the European Convention on Human Rights. It is only to be regretted that the authors limited their review to only a handful of countries of Western Europe. In numerous countries of Central and Eastern Europe, the polygraph is used today in criminal investigations as well as court evidence. The practice in the countries of this region is interesting and highly differentiated. Some countries, for example Poland, have gained experience in using polygraph tests since the 1960s and have gathered an interesting scientific heritage in the field. In Russia, the tradition of using the polygraph is much shorter; nevertheless, it is a country where currently at least several tens of thousands of polygraph tests are performed every year, of which more than every other one is performed in the private sector.

The authors close their article with a discussion of the future of polygraph testing. They believe that the results of polygraph tests will be ever more precise, in parallel to increased practical experience and experimental research. They also turn their attention to the fact that the new techniques of studying the brain (EEG, fMRI) may allow a better grasp of the process of lying. Yet they are right to point out that these methods raise new problems of both a legal and an ethical nature.

Dehon F. (2006), "Paper at the 41st APA Annual Meeting", Las Vegas, 2006.

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Barry L. McManus

Liar. The Art of Detecting Deception and Eliciting Responses

Global Traveler LLC, Leesburg 2008, pp. 126

The cover of the book tells the reader that the author is a former CIA Chief Polygraph Examiner and Interrogator, which naturally is a strong incentive to dive in, but which also makes the reader's expectations soar. Fortunately, the expectations are satisfied. Moreover, since the book is relatively brief and written in a focused, matter-of-fact manner, it is one of the rare texts where every sentence counts.

The book is filled with neither theoretical sophistication nor redundant erudition (despite its rich list of references). At first glance, it might therefore appear to be a sort of introductory manual targeted at a wide general audience. However, I believe that a person with no inside knowledge of police or intelligence operations will understand little of it, since the subtleties, allusions and understatements are accessible only to readers who have already had their fair share of real-life confrontations with an opponent. It seems therefore that the audience that *Liar. The Art...* is in fact addressed to is law enforcement investigators and information collectors, whether in the public or private sector, already rather advanced in their professional career.

In terms of specific contents, it must be said that McManus gives little room to polygraph examinations. He (partially) devotes one chapter to the subject matter, but the discussion is limited to a general description of the method

and the controversies to which it gives rise. However, in the closing remarks he notes that "…the polygraph is still the best tool available for the detection of deception and will continue to play an integral role in both the law enforcement and intelligence communities" (p. 16).

The key question that the author asks and that the book is organised around and attempts to answer is: "How do you convince someone to provide information that is not in his/her best interest?" The entire book is a book of instruction of sorts, guiding the reader through the various aspects of the answer to this question.

Thus, we learn about behavioural and verbal signs of truth and deception, we study how to develop interviewing strategies, how to establish rapport between the interviewer and his "Subject" and, finally, how to elicit information. A note on an issue which is interesting and noteworthy: McManus consequently capitalises the word "Subject". This is no random choice, given how he emphasises the relevance and importance of treating the person who is being interrogated with respect, and points to such behaviour as one of the crucial conditions of the interrogator's success.

As a sample of how knowledge is presented in the book, let me comment on two matters which are, in my opinion, of the greatest significance, i.e. establishing rapport and elicitation. "Rapport is established the moment eye contact is first made and is continually built upon as personal interaction progresses (…), by showing patience, sincerity and compassion for the people you're interviewing. (…) Rapport can easily be developed and exploited if you make the effort to do so", writes McManus. It is therefore important to ask the Subject, "How was your trip today?", "Is there anything I can do to make you more comfortable?" The rapport, once established, can easily be lost. Factors conducive to such loss include: lack of professional knowledge on the part of the interrogator, his/her sloppy appearance or slouching, downgrading the status of him/herself or of the Subject, arrogant attitude, interrupting or finishing sentences, abruptly changing the subject, "going for the jugular", etc. According to McManus, "subtlety is the key to your success in establishing rapport" (p. 43-44). This introduction is followed by a number of specific instructions on how to proceed depending on how the situation develops. The instructions are often illustrated with specific examples of dialogues which help put the matter in an appropriate tactical context. Brief exercises which allow the reader to evaluate his/her newly acquired knowledge contribute to the educational value of the text.

McManus emphasises on a number of occasions that the purpose of elicitation is not to gain a confession (where the Subject admits to being guilty of certain acts), but to gain valuable and reliable information. However, it is difficult not to notice that an authentic confession constitutes, in the eyes of the author, precisely such valuable information. This comes as no surprise, since we read in the book that "providing the Subject with justification for his/her guilty wrongdoing is the key to getting a confession", and "using the Subject's emotions, values, and self-perceptions is the key to getting credible and reliable information" (p. 55-56).

The chief subject matter of the book, i.e. a detailed presentation of strategies of gathering information from individuals, is complemented by a broad discussion of how intercultural differences influence the above-mentioned strategies. It is clear that this aspect is of particularly keen interest to McManus. A sizeable portion of this section is devoted to issues of contacts with representatives of Middle Eastern culture. The reader is explained how easily a gap in know-how may lead to a failure in an interview with an inhabitant of that area. One question that seems neutral but pertains to the Subject's spouse may be enough even to break rapport that has been established previously, and the loss may be impossible to remedy. Attention is drawn to a different understanding of responsibility between American and Middle Eastern culture; an Arab interlocutor should not be told "you lost it" since he/she is likely to turn to denial; instead, "it went missing" or "it was lost" is more appropriate. An appropriate gesture to greet someone in the Middle East is to squeeze gently both of their hands. It makes a good impression to express admiration for the contribution of the Arab culture to global thought in astronomy, geometry, mathematics, etc. The list of instructions and useful hints goes on.

A similar description is provided with regard to other cultures. In Latin America, a bare minimum of initial greetings requires a person "to say Hello, to shake hands, and to ask about one's family. Anything less is an insult and provokes a deep emotional reaction; it is difficult to communicate effectively with clenched teeth" (p. 82). This by no means is to say that it is enough to know a few handy pointers. Latin America is enormously diverse, and cultural differences between Ecuador and Argentina are, according to McManus, as great as those between France and China. In Africa, in turn, what is truly important is the understanding of the continent's long tradition and rich heritage, and the acute sensitivity on the African continent to the issue

of the slave trade. The above-mentioned illustrative examples are of course just a glimpse at the knowledge the book offers with regard to the problem of intercultural differences in information gathering.

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Liar. The Art… is surprisingly packed with information, considering the book's moderate length. The language is simple, but extremely to the point, which forces the reader to pay attention relentlessly, and to constantly stay close to what the author is saying. At times one has the impression that McManus himself stands close by, and with a gentle smile guides the reader, at the same time requiring the reader to use his/her wits, to think clearly, and to be ready to undertake a significant effort.

The book was written in the aftermath of 9/11. In McManus's own words, "there are no fool-proof recipes for detecting deception and eliciting information; however, information is the best defense, as well as the most viable weapon in resolving any conflict, terrorism being no exception". The book itself is a signature that Barry L. McManus puts in huge letters under the old piece of wisdom: *Plus ratio quam vis*.

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To publication will be accepts unpublished research papers as well as review article, case reports, book reviews and reports connected with polygraph examinations.

Submitted manuscripts must be written in English.

All papers are assessed by referees (usually from Editorial Board), and after a positive opinion are published.

Texts for publication should be submitted in the form of normalized printout (1800 characters per page) and in electronic form (diskette, CD), or sent by e-mail to Editorial Office.

The total length of research papers and review article should not exceed 12 pages, case reports – 6 pages, and other texts (book review, report) – 5 pages.

The first page of paper should contain: the title, the full name of the author (authors), the name of institution where the paper was written, the town and country.

Figures should be submitted both in printed form (laser print, the best) and electronic form.

Tables should be numbered in Roman numerals and figures in Arabic ones.

Figures, tables, titles of figures and titles of tables should be included on a separate page. The places in the text where they are to be included should be indicated.

The references should be arranged in the alphabetical order according to the surnames of the authors.

The references should be after the text.

Each reference should include: the surname (surnames) of the author (authors), the first letter of author's first name, the title of the book, year and place of the publication, the name of publisher, or the title of the paper, the full title of the journal, the year, the volume, the number and the first page of the paper.

For example (in references):

Reid J., Inbau F. (1966), *Truth and Deception: the Polygraph ("Lie-detector") Techniques*, Williams & Wilkins, Baltimore.

Abrams S. (1973), *Polygraph Validity and Reliability – a Review*, Journal of Forensic Sciences, 18, 4, 313.

and (Reid, Inbau, 1966), (Abrams, 1973) inside text.

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