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Treatment of Sex Offenders: Strengths and Weaknesses in Assessment and Intervention. Polygraph Testing Of Sex Offenders*

Don Grubin

Introduction

From tentative beginnings in the 1990s, post conviction sex offender testing (PCSOT) has become increasingly incorporated into sex offender treatment and supervision in both the United States and United Kingdom. McGrath et al (2010), for example, reported that nearly 80% of community adult sex offender programs in the US and over half of residential ones make use of polygraph testing to inform treatment or supervision, while in the UK mandatory testing of high risk sex offenders on parole was introduced in 2014 after a number of trials. Its spread to other countries is likely, with a number of jurisdictions actively considering its use.

The growing influence of PSCOT, however, is not without controversy. The speed with which it has been embraced by programs has tended to outpace evidence, with much of its impetus coming from clinical experience supported by a research base of limited robustness. Only recently have more well designed studies been carried out. Although this is not unusual when new procedures are introduced, PCSOT carries with it significant baggage associated with polygraph testing more generally. Thus, while proponents claim that PCSOT makes important contributions to sex offender treatment and management by bringing to attention changes in risk, facilitating disclosures, and perhaps encouraging offenders to modify their behaviour (Grubin, 2008; Levenson, 2009), others are more sceptical. Commentators, for example, have argued that the type of polygraph test used in PCSOT lacks validation, is unscientific and potentially dangerous (Ben-Shakhar, 2008; Iacono, 2008), may adversely affect the therapeutic alliance between offender and therapist or supervisor (McGrath et al, 2010; Vess, 2011), is based on manipulation or intimidation, potentially breaching a number of basic ethical principles relating to autonomy and non-malfeasance (Chaffin, 2011; Cross & Saxe, 2001; Meijer et al, 2008), and, common to all critical commentaries, lacks research to show that it is effective (Rosky, 2013).

To what extent, then, does PCSOT make a positive contribution to sex offender treatment and management, a question sometimes simplified to, 'does it work?' As a first consideration, it must be able to differentiate truth telling from deception reliably, and it should facilitate the disclosure of clinically relevant information. If it meets these requirements, it then needs to be demonstrated that in doing so it has a beneficial impact on treatment and/or management. But even if PCSOT does 'work' in this way, if in the process it crosses ethical or legal red lines then it would be hard to justify continued reliance on it.

Polygraph Testing

As indicated above, there are two primary outputs from a polygraph test, each of which complements the other.

The first, and what people usually associate with polygraph testing, is test outcome, that is, whether an examinee 'passes' or 'fails' the test. Although the focus is typically on 'lie detection,' determination of truthfulness is equally important. In order to shift attention away from the polygraph as a 'lie detector,' therefore, many practitioners now refer to it as a means of 'credibility assessment' (Raskin et al, 2014). The fundamental questions here, of course, are how accurate polygraphy is in detecting deception and confirming honesty, and whether that level of accuracy is sufficient for the setting in which it is being used. Unfortunately, this second question is often overlooked, an important oversight when translat-

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ing research findings regarding accuracy into practice – what may not be accurate enough in a national security context or in a court of law may be sufficient for investigating crime or when used post conviction.

The second output of a polygraph test is disclosure. Numerous studies have reported that individuals report information during a polygraph examination they would otherwise have kept to themselves. Critics sometimes dismiss this effect as being a 'bogus pipeline to the truth' as they say it depends on an examinee believing that the polygraph 'works', and that disclosures would not occur if examinees did not hold this belief. This assertion, however, begs two questions: the extent to which disclosures are in fact dependent on a belief in the accuracy of the polygraph test, and if they are, the level of accuracy required to trigger this effect. As will be discussed later in this chapter, while many social psychology studies have demonstrated that disclosures do increase when subjects believe they are attached to a 'lie detector,' the strength of this effect is unclear. A third more philosophical consideration also arises in respect of this issue – if disclosures are a function of a belief in polygraph accuracy, but polygraphy is shown to meet the level of accuracy required to trigger this belief, is it still correct to refer to the phenomenon as a 'bogus' pipeline?

Thus, although discussions about PCSOT often get bogged down in arguments about accuracy levels and the basis of disclosures, both issues are more complex than they appear at face value.

What the polygraph records

That there is an association between deception and physiological activity has been known for centuries. One of the earliest and clearest expressions of this was by Daniel Defoe, who when writing about the prevention of street robberies in the 18th century, observed:

Guilt carries fear always about with it; there is a tremor in the blood of the thief that, if attended to, would effectually discover him . . . take hold of his wrist and feel his pulse, there you shall find his guilt; a fluttering heart, an unequal pulse, a sudden palpitation shall evidently confess he is the man, in spite of a bold countenance or a false tongue. (Defoe, 1730/quoted in Matte, 1996)

Fairly, though, Defoe also noted, "The experiment perhaps has not been try'd."

While the phrase 'a tremor in the blood' is so often quoted by those who write about the history of the polygraph that it is in danger of becoming a cliché, it nonetheless lays the groundwork for both the basis of polygraph testing, and some of the misconceptions associated with it.

The involuntary physiological responses associated with guilt and deception recognized by Defoe are now known to be caused by activity in the autonomic nervous system. These responses, however, are not unique to deception – lots of things can make the blood tremor besides guilt and lying, and no physiological variable has yet been discovered that is specific to deception. Because of this, it is sometimes concluded that polygraphy, or any other technique that relies on recording and interpreting physiological activity, cannot possibly work. But there need not be a unique physiological lie response for polygraph testing to be effective; instead, what matters is whether physiological reactivity recorded in the context of a polygraph examination discriminates truth telling from deception at levels sufficiently above chance to make the technique meaningful and worthwhile. False positive and false negative findings occur with every test and investigation; more relevant is being able to quantify their frequency, and ensure that whatever actions follow a test result take this error rate into account.

A second misconception that can be seen in Defoe's observations is that physiological responses associated with deception are the result of emotion, especially the emotions of fear and anxiety. This mistake leads some to argue that anxious individuals, either inherently or because they are made anxious by the circumstances of the test, are likely to wrongly 'fail' for this reason. Other critics are concerned that in order for the test to work polygraph examiners must induce anxiety or fear in examinees, which is ethically dubious (BPS, 1986; Vess, 2011). There is also a belief that psychopathic individuals, because of their low levels of anxiety and emotional

responsiveness, are more likely to 'beat' the test. But though there is uncertainty regarding the mode of action of polygraphy and the neuropsychological basis of the physiological reactions it records, it is clear that emotional reactivity is only part of the story, and that a number of cognitive processes associated with deception contribute to what the polygraph observes. Anxiety and fear, except insofar as they indicate that the examinee takes the examination seriously, are likely to be minor components at best. More will be said about this later.

Cardiovascular, respiratory, and electrodermal activity measured by recording devices as opposed to being observed indirectly began to be used as a means of detecting deception in the late 19th and first part of the 20th centuries, mainly on their own but in some cases together, both in Europe and the United States (Alder, 2007; Krapohl and Shaw, 2015). Criminologists, psychologists, and physicians such as Cesare Lombroso, Hugo Munsterberg, Georg Sticker, Vittorio Benussi, Walter Summers, William Marston, John Larson and Leonarde Keeler researched and applied their various techniques, sometimes with phenomenal claims of success. In the 1930s this work coalesced into instruments that could simultaneously record data from the three physiological systems, giving rise to what became known as the polygraph. Although the hardware has improved since then, and the process has become digitalised so that ink pens writing on moving paper are no longer required, little has changed in terms of the basic physiology that is recorded.

In what way is activity in these physiological systems associated with deception? Traditionally polygraph examiners are taught that what they are observing is a 'fight flight, or freeze' response caused by the fear of being caught out in a lie and the consequences that follow, implicitly accepting an emotional basis to the test's mode of action. There are a number of major problems with this explanation, however: response characteristics that are associated with deception on the polygraph test are not identical to what is seen in a 'fight, flight or freeze' scenario, deceptive responses are recorded even where there is little anxiety and no consequence attached to being caught out (for example, in tests where examinees are simply told to pick a number and then to lie when asked if they have done so), and not all polygraph formats require lying at all but instead relate to the 'recognition' of relevant items.

The reality is that we are well short of understanding the mode of action of the polygraph, indicated by the number of theories proposed to explain it (National Research Council, 2003; Nelson, 2015), although it is now accepted that a range of mental processes are involved in addition to emotion. Important are concepts and factors such as 'differential salience,' (that is, differing degrees of importance or threat represented by the questions asked on the test), the cognitive work involved in lying and in inhibiting truth telling (truth telling being the default position), autobiographical memory, orienting to 'threat,' and attention, (Senter et al, 2010; Nelson, 2015), which interact to produce arousal in the autonomic nervous system that can be seen in a number of peripheral physiological processes.

While a lengthy discussion regarding the physiological and psychological mechanisms underlying polygraphy cannot be pursued here, the fundamental point is that conducting a successful polygraph test is about more than simply attaching the recording hardware and then asking questions. Instead, the examiner must work at ensuring that whatever reactions are recorded are produced because the examinee is deceptive to the questions being asked, rather than by other possible causes of autonomic arousal. This is achieved in a lengthy pre-test interview, and requires examiner training and skill, in other words, a competent examiner. Given that the process is so heavily dependent on the examiner's capabilities it has been argued that polygraphy should not be seen as a 'scientific test' (BPS, 2004), but this is perhaps more of a semantic than a practical issue – operator skill is important in all forms of scientific testing. But whether 'scientific' or not, what matters is whether, in the hands of a competent examiner, polygraph testing can be shown to be a reliable means of distinguishing truth telling from deception.

In terms of PCSOT, there is no need to induce anxiety in examinees, anxious individuals are no more or less likely to 'fail' the test,

and, because the generation of fear or anxiety is irrelevant, psychopaths are no more or less likely to wrongly 'pass' the test (Raskin & Hare, 1978; Patrick & Iacono, 1989). Furthermore, as will be discussed later, the examinee does not need to be deceived about the accuracy of polygraphy nor manipulated in other ways for the test to be successful.

Polygraph accuracy

While the physiological targets of polygraph testing have not changed much since the 1930s, numerous testing techniques, question formats, scoring systems, and specialised applications have emerged since then, often introduced with little empirical support. The plethora of approaches and the associated lack of standardisation have made it difficult to provide clear estimates of polygraph accuracy.

A number of initiatives have meant the situation has improved (Kraphol & Shaw, 2015). Chart scoring, as opposed to decisions based on a global overview of the polygraph chart, was introduced in the 1960s, a hardening of testing protocols took place between the 1960s and 1990s, increased acceptance of blind scoring of charts as a means of Quality Control to overcome the risk of examiner bias became more commonplace in the 1990s, research in the early 2000s better clarified response patterns that are indicative of deception (and just as importantly, response patterns that aren't) and the amount of variance explained by the different physiological channels, and in the late 2000s the American Polygraph Association undertook an exercise to validate testing techniques (American Polygraph Association, 2011). All of this has provided a better scientific basis on which to evaluate the efficacy of polygraph testing.

The most definitive review of polygraphy accuracy to date has been carried out by the National Academies of Science in the United States. It concluded that "polygraph tests can discriminate lying from truth telling at rates well above chance, though well below perfection" (National Research Council, 2003, p. 4). Accuracy for the most commonly used test format, the comparison question test (a version of which is employed in PCSOT), was estimated to be between 81 to 91%, which is highly supportive of a meaningful association between what the polygraph records, truth telling and deception.

The National Academies review was carried out on behalf of the US Department of Energy, triggered by allegations of espionage at the Los Alamos nuclear weapons facility, and was designed to advise on the use of polygraph testing for personnel security vetting. Its overall conclusion was that an error rate of 10 to 20% was too high for this type of application given the low levels of deception likely to be found in the population to be tested (one hopes that there are not many spies working in federal agencies), and the disproportionate number of false positive findings such an error rate would imply. Although polygraph proponents disagree with this conclusion, arguing that it is based on a misconception of the way in which security vetting is undertaken because in this setting it acts as an initial screen rather than providing a definitive outcome, more important in terms of PCSOT is the review's observation that polygraphy becomes viable when the underlying rate of deception is over 10% – a rate which most observers, even those critical of polygraphy, would accept is probably exceeded in sex offender populations.

For a number of reasons, however, the National Academies Review is not the end of the story, at least in terms of PCSOT. Its estimate of accuracy is based on single issue, 'diagnostic' tests, that is, tests in which a single known issue is being investigated, for example, whether an individual was involved in a bank robbery. Although this is sometimes the case in PCSOT, as when the focus is on specific behaviors reported to have occurred during an offence, or where the matter of concern is whether the offender is responsible for a new crime, the majority of tests carried out in PCSOT are screening in nature. In screening tests a number of behaviors are explored, but there is not a known event that underpins the thrust of the exam.

Screening tests are generally considered to be less accurate then single issue tests, although there are insufficient trials from which to determine their precise level of accuracy. Screening tests however tend to have higher false positive rates (tests which wrongly label an examinee as deceptive). Two studies

used anonymous surveys with sex offenders in the US to ask about their experiences of being wrongly accused of deception, and also of instances where deception had been missed (Grubin & Madsen, 2006; Kokish et al, 2005). The findings were very similar, with responses from offenders in both studies suggesting an accuracy rate for PCSOT between 80 and 90%, reassuringly similar to the National Academies estimate.

Because of its likely error rate, the utility of PCSOT tends to be emphasised rather than its accuracy, with disclosures seen as more important than test outcome. In addition, it is recommended that outcome in screening tests is reported as 'significant response' or 'no significant response' rather than 'deception indicated' or 'no deception indicated' as it is in single issue tests. However, a more recent initiative has expressed polygraph test outcome as a probability statement with confidence intervals derived from data normed on large sets of confirmed tests. Referred to as the 'Empirical Scoring System' (ESS), this allows a better judgment to be made about the degree of confidence one can have in a given test result (Nelson et al, 2011). Although the data base on which ESS is built could be larger, and while it still requires independent validation, this type of approach provides greater clarity on polygraph test accuracy in environments such as PCSOT.

The error rate associated with polygraphy, and its screening function in most PCSOT settings, means that it is probably a mistake to talk about an individual 'passing' or 'failing' the test. One doesn't pass or fail a screening exam of any sort. The aim of screening is to identify those who require further investigation. In the case of PCSOT, significant responses to some questions are observed, which might be thought of as 'screening positive', but this is different from failing a test. It is therefore probably more sensible to think in terms of positive and negative predictive values: the former referring to the likelihood of a true positive (that is, deception) when an individual shows a significant response, and the latter to the likelihood of truthfulness when no significant responses are recorded. It is usually the case that one is higher than the other, providing an indication of whether one should be more confident in deceptive or truthful calls (the first where it the positive predictive value is higher, the second when the negative predictive value is).

There remains the problem of examiner competence and its impact on test accuracy. However, if properly trained examiners use correct techniques that are administered properly then their accuracy rate should be similar to that reported in the research literature. Ensuring this is the case requires a well-constructed quality assurance and quality control program, which unfortunately many PCSOT programs lack. But this is a reason to improve programs rather than to dismiss polygraphy. Provided it is in place the important question becomes not whether polygraph is 'accurate', but whether accuracy in the range of 80 to 90% is accurate enough.

The answer to this question will depend on how test outcome is used. An error rate of 10 to 20% is clearly too high to warrant sending someone to prison or taking away their livelihood, but not too high to inform decisions about treatment engagement, changes in monitoring conditions, or the need for further investigation into possible transgressions. This is particularly the case when one remembers that typically we make these types of decision based on our own determination of whether or not someone is deceptive, even though in experimental settings the ability of the average person to do so accurately is rarely above 60% (Bond & DePaulo, 2006; Vrij, 2000).

Utility and Disclosure

Polygraphy is known to increase the likelihood that an examinee will disclosure previously unknown information. There are many anecdotal accounts of this phenomenon in both investigative and screening settings, but the best evidence for this effect is found in sex offender testing where numerous studies describe significant increases in self-report of previous offence types and victims, deviant sexuality, and risky behaviors (for example, Ahlmeyer et al, 2000; Grubin, et al, 2004; Heil et al, 2003; Hindman & Peters, 2001; Madsen et al, 2004). This work, however, lacks robustness in that comparisons are usually made in terms of what was known about an offender before and after polygraph testing rather than

with contemporaneous comparison groups in which polygraph testing is not used. As critics readily point out, this makes it difficult to disentangle the effects of polygraphy from other factors such as treatment impact or changes in supervision.

The lack of a comparison group with which to determine polygraph efficacy in facilitating disclosures has been addressed in two large UK studies, both of which confirmed the findings of earlier work that showed increases in disclosure when polygraphy is used. In one of these studies polygraph testing was voluntary (Grubin, 2010), while in the other it was a mandatory condition of a parole license (Gannon et al, 2012; Gannon et al, 2014).

In the trial of voluntary testing (Grubin, 2010), the supervision of nearly 350 polygraphed offenders was compared with 180 sex offenders from probation areas where polygraphy was not used. Just over 40% of eligible offenders agreed to be tested, of whom 47% were tested more than once. The majority were taking part in treatment programs. Probation officers reported that new disclosures relevant to treatment or supervision were made in 70% of first tests, compared with 14% of the non-polygraphed offenders making similar types of disclosure in the previous six months. A similar difference was found in respect of retests (only in this case the comparison was with three months before). The disclosures made by polygraphed offenders were rated as 'medium' or 'high' severity (the former relating to behaviors indicative of increased risk, the latter to actual breaches or offences) in over 40% of cases. The odds of a polygraphed offender making a disclosure relevant to his treatment or supervision were 14 times greater than they were for non-polygraphed offenders.

Although the test and comparison groups reported in Grubin (2010) did not differ on demographic or criminological variables, the fact that those tested were volunteers could have introduced bias. Because of this the mandatory trial described by Gannon et al (2012 and 2014) was considered necessary before a decision could be reached about implementing mandatory testing nationwide (it was a requirement set by the UK Parliament). Like the earlier study, a comparison group was used. Unlike it, the mandatory trial was limited to high risk offenders (defined as those released on parole following a prison sentence of a year or more), and though many had undertaken sex offender treatment in prison, relatively few were involved in community treatment programs. The focus of the mandatory trial, therefore, was on the impact of polygraph testing on supervision only.

There were over 300 offenders in each group, which again did not differ on demographic variables. Although the mandatory trial involved an overall higher risk group and many fewer were in treatment than in the voluntary trial, its findings were similar. Significant increases were found in the number of individuals who made what were referred to as 'clinically relevant disclosures' and in the number of disclosures these individuals made in the polygraph group. This was particularly noticeable in respect of sexual and risk related behaviors. However, the odds ratio of a disclosure being made was lower at 3.1.

In both studies significantly more actions were taken by probation officers who managed offenders subject to polygraphy than by probation officers supervising comparison offenders. One interesting finding reported in Gannon et al (2012) was that while 73% of interviewed probation officers believed the offenders they supervised were 'open and honest' with them, this was the case for only 25% of the probation officers who supervised polygraphed offenders. This is perhaps an explanation for the finding in Grubin (2010) that whereas probation officers of polygraphed offenders were more likely to increase risk ratings, risk ratings were more likely to be decreased in the comparison group.

Although the impact of polygraph testing on disclosures is clear, the question still remains whether it is simply a 'bogus pipeline' effect. As described earlier, this refers to the increase in disclosures being the product of a belief that the polygraph 'works,' the implication being that disclosures would dry up in the absence of such a belief. As one critic commented in a newspaper article, it relies on offenders "not knowing how to use Google" (London Daily Telegraph, 2012).

A number of social psychology studies have demonstrated that subjects who believe

they are attached to a 'lie detector' appear to be more honest in their answers to questions regarding attitudes and behaviors, which has been interpreted as a reflection of social desirability or acquiescence biases (Jones & Sigall, 1971; Roese & Jamieson, 1993). But the effect is not in fact that great – a meta-analysis of 31 published reports found a mean effect size of d=.41, which is in the small to moderate range (Roese & Jamieson, 1993).

Another factor to take into account when considering the 'bogus pipeline' hypothesis is that all of the bogus pipeline studies are based on the use of a near 100% lie detector. It is not clear from them what would happen if, rather than being sold as being 100% accurate, the 'lie detector' was instead said to have an accuracy rate "well above chance, though well below perfection" as described by the National Academies in respect of polygraph testing (National Research Council, 2003). In as yet unpublished research our group found that a 'lie detector' claimed to have a 75% accuracy rate (i.e., a level below that attributed to polygraphy) appears to elicit disclosures with a frequency similar to that of a near 100% accurate lie detector. This would seem to suggest that if part of the increase in disclosures brought about by polygraph testing is due to a belief in its lie detecting properties, then whatever else it may be the pipeline is not a bogus one.

Regardless of the merits and impact of the 'bogus pipeline effect,' the much more psychologically interesting question is what makes individuals disclose in this setting anyway, bogus pipeline or not. It may be that offenders disclose because they believe they will be, or have been, 'caught out' by the polygraph, which would be consistent with research showing that one of the best predictors of whether a suspect will confess to a crime is the belief that there is good evidence against them (Gudjonsson et al, 2004). As indicated above, however, the 'bogus pipeline effect' itself is unlikely to be the entire reason for increased disclosures, explaining only a small part of the variance. It could be that a polygraph test allows the offender an opportunity to change his account in a face-saving manner (after all, he was found out by a 'lie detector'), or it may simply be that the dynamics of the interview itself are different from what takes place in normal supervision. Whatever the reason, the effect deserves increased research attention, and consideration given as to how to enhance it.

One further issue to address in respect of disclosures is whether the circumstances of a polygraph test result in offenders making false admissions in order to please polygraph examiners or to explain a 'failed' test. Because many of the disclosures made in PCSOT are in any case difficult if not impossible to verify (for example, how can one determine whether or not an offender has been masturbating to deviant fantasies?) it can be a challenge to confirm their veracity. What little research there is in relation to this suggests that false admissions occur, but not often. Two studies have addressed this question using anonymous surveys with sex offenders in the US who were asked whether they had ever made false disclosures in a polygraph test (Grubin & Madsen, 2006; Kokish et al, 2005). In both studies fewer than 10% of offenders indicated that they had done so; in the Grubin & Madsen (2006) study, those who reported making false admissions had higher scores on the NEO neuroticism scale and lower scores on the conscientiousness scale, suggesting that those who make false admissions during a polygraph test may share characteristics with those who make false confessions in police interviews (Gudjonnson et al, 2004; Gudjonnson & Pearse, 2011). In any case, while the issue is not trivial, it does not seem to be a major problem.

Proponents of PCSOT argue that whatever the reason for increased disclosure by offenders who undergo polygraph tests, the effect is genuine and valuable. They ask whether critics are really suggesting that this information should not be sought or used because of concerns regarding the evidence base for the mechanisms that generate it. But resolution of this issue perhaps depends more on how PCSOT is implemented than on the academic arguments regarding polygraph itself.

The implementation of PCSOT

The initial use of polygraph testing with sex offenders was as a clinical assessment to assist treatment providers in gaining fuller histories with which to inform treatment

plans. The term 'post conviction sex offender test' started to be used in the 1990s in reference to tests administered to individuals under court order, court supervision or court ordered treatment, with the intention of enhancing treatment or improving supervision (Holden, 2000). Its aim was to generate more complete information about an offender's history, sexual interests and functioning, and offending behavior based on disclosures and test outcome. This has been referred to as adding "incremental validity to treatment planning and risk management decisions" with which to improve decision making (Colorado, 2011), and can perhaps be thought of more simply as 'information gain.'

In the late 1990s the 'Containment Model' was developed by practitioners in Colorado (English, 1998). It has since become the basis of many PCSOT programs in the United States, although it has not taken root in the United Kingdom. The Containment Model refers to a triangle formed by supervision officer, treatment provider and polygraph examiner, although others may also be involved, in which the offender is 'contained.' It depends on good communication between agencies, with information obtained by one informing the actions of others.

While the Containment Model has clear attractions from a public protection perspective, it implies that all sex offenders require high levels of external control to keep them from reoffending. Compliance in the immediate term may be obtained, but whether it leads to longer term change is uncertain. And though some offenders may require 'containment,' others genuinely seek to improve their internal controls and engage with treatment and supervision. In other words, there are some offenders who work with treatment providers and supervisors, and there are others who work against them. For the latter group containment may be necessary, with the polygraph serving primarily as a lie detector to indicate when risk is increasing (related to this is a finding of Cook et al (2014) that recidivism rates were higher in offenders who avoided or delayed their polygraph), but for the former group of offenders polygraphy can act as a truth facilitator, encouraging them to discuss problematic thoughts and behaviors and providing reassurance that their risk is stable. It should be remembered that polygraphy not only detects lies, it also catches offenders telling the truth.

Whether or not following a strict containment approach, PCSOT has moved away from being an accessory of treatment to assume a more central role in offender supervision. It remains, however, the servant of those working directly with the offender, functioning to provide information about whatever is most relevant at the time. In this respect, different test types are relevant depending on the offender's circumstances.

Test structure

Before describing the types of test used in PCSOT, the basic structure of a polygraph session needs to be described. The typical format employed in PCSOT is the 'comparison question technique.' It consists of three phases: a pre-test interview, the examination itself, and a post-test interview.

> The *pre-test* is the longest part of the examination, and can take from one to two hours. Amongst other matters information is collected about the examinee's background and current behavior, and the test questions are established and reviewed in detail. Many disclosures take place during this part of the process.
>
> The *polygraph examination* consists of 10 to 12 questions, of which just 3 or 4 target the areas of concern and are referred to as the 'relevant questions.' Responses to the relevant questions are compared with so-called comparison questions to determine whether or not they are indicative of deception. More will be said about this shortly. Polygraph questions need to be simple, answerable with a yes or no, and relate to specific behaviour rather than mental state, intention or motivation.
>
> In the *post-test interview* the outcome of the exam is fed back, with the examinee given an opportunity to explain deceptive responses. In the UK study of voluntary testing, one third of disclosures were made during the post-

test (Grubin, 2010).

As referred to above, in the comparison question technique relevant questions are evaluated against comparison ones. If physiological responses to the former are greater than the latter, the examinee is judged to be deceptive; vice versa and the examinee is considered truthful. The comparison questions often take the form of a *'probable lie,*, that is, questions that the examinee is unlikely to be able to answer truthfully. Examples of probable lies are, 'have you ever lied to a loved one?' or 'have you ever stolen from a family member?' The theory is that truthful subjects will find these questions more concerning than the relevant ones because of their implications and thus show greater responses to them, while the deceptive examinee will be more responsive to the relevant questions because they represent more of a threat. The strength with which relevant questions exert a greater pull on the examinee than the comparison ones has been called 'relevant issue gravity' (Ginton, 2009), which is a tidy way of packaging the various cognitive processes that determine autonomic arousal in response to polygraph questions.

The probable lie approach has been criticised on a number of grounds. First, the underlying theory that the differential response to the two question types relates to truthful individuals being more worried about what are in effect less serious comparison questions is frankly implausible (Ben-Shakhar, 2008; National Research Council, 2003). But given that the technique has been shown to be able to identify deception this suggests we need a new theory, not that the technique itself is faulty. Others are concerned that the probable lie approach means the test is based on deceiving the examinee, and requires the examinee to be forced into a position of having to lie (Cross & Saxe, 2001; Meijer et al, 2008; Vess, 2012). This ethical objection, however, is based on a misconception – the cognitive work of the probable lie doesn't arise from the lie, but from the uncertainty associated with the question. Indeed, comparison questions can take the form of a 'directed lie' in which the examinee is instructed to lie to a question such as 'Have you ever made a mistake?,' which involves neither manipulation nor dishonesty. More will be said about directed lies later in this chapter.

Test types

There are four basic types of polygraph test used in PCSOT, some of which have variants to them (American Polygraph Association, 2009).

Sex History Exams. The purpose of this test is to obtain a fuller and more accurate account of an offender's sexual history, including the type and range of deviant behaviors in which he has engaged, the age at which they commenced, and his history of involvement in unknown or unreported offenses. There are two forms of this exam, one that focuses on unreported victims of contact offenses, the other on sexually deviant behavior more generally and offenses that don't involve force such as voyeurism or internet related offending. The rationale for the separation is that the more severe potential consequences associated with the former behaviors may contaminate responses to the latter. Prior to the polygraph exam the offender completes a sex history questionnaire, usually as part of sex offender treatment. The questionnaire is the focus of the examination, but only selected questions are asked during the test itself.

The intention of the Sex History Exams is to develop a better understanding of risk and of treatment need. There can be a tendency, however, for examiners to dig for much more detail than is needed to achieve these aims, making the procedure an unrealistic exercise in recall for the offender as well as a potentially humiliating one; more information is not necessarily better information. In addition, because it is based on a lengthy questionnaire which covers behaviors that have taken place over many years, the risk of false positive outcomes (that is, wrongly 'failing' the test) is increased. This is an important consideration given that about half of American community and a third of residential sex offender treatment programs for adult males require the sex history exam to be passed in order for treatment to be completed successfully.

A further problematic issue associated with Sex History Exams is what to do about self-incriminating disclosures. Programs typically try to get around this be ensuring that only general information about past offenses is obtained, but in some states even this

minimal level of disclosure needs to be passed to the authorities. In reality, however, this is not a difficulty unique to polygraph testing and applies to treatment programs generally. Whatever solution works for the program should be sufficient for PCSOT.

The following are two examples of how Sex History Exams can be helpful to treatment (these and subsequent examples are taken from the UK polygraph trials):

> An offender on parole following a conviction for the indecent assault of his stepdaughter disclosed during a Sex History Examination a large amount of previously unknown pornography use and cross dressing. Subsequent to the test he began to discuss this and his sexual fantasies more generally in treatment for the first time.
>
> An offender in his fifties with no sex offending history was convicted of internet related offences. In a Sex History Examination he admitted to stealing underwear from his sister's house, to sexual fantasies regarding schoolgirls, and to sitting in cinema car parks to watch young girls. Based on this and other fantasy related information he disclosed during the test new treatment targets regarding fantasy and fantasy modification were identified and delivered.

Critics argue that information from Sex History Exams tell us nothing new in that it would be a surprise if offenders hadn't engaged in deviant behaviours besides their offenses, and that there is little evidence to show that the additional information adds meaningfully to risk assessment or treatment provision (Rosky, 2012). This criticism seems odd, however, given that sex history questions are asked routinely in sex offender assessment and are considered an important part of the evaluation, the only difference being that there is more likelihood of getting an honest account during a polygraph examination.

Instant Offense Exam. This exam type explores behavior that took place during the instant offense where there is inconsistency between victim and offender accounts, or where the offender denies important aspects of what took place. A variant of this test relates to prior allegations where there hasn't been a conviction. Like the sex history exam, this test is directly relevant to treatment. Also like the sex history exam there is a risk that the examiner will go on a fishing exercise seeking detail that doesn't take treatment any further. Used properly, however, it can overcome denial that is blocking treatment progress.

Below is an example of how an Instant Offense Exam assisted treatment in a perhaps unexpected way:

> An offender was on license having committed an indecent assault on a child in a supermarket when intoxicated. He admitted the offense, but denied any memory of having pushed his groin into the girl's back as reported by her mother even though he accepted this could have happened. Much time was spent in the treatment group trying to overcome his 'denial'. On an Instant Offense Exam he was questioned about his lack of recall, and he was found truthful. The consistency of his self-report taken together with the test result led to his account of partial amnesia being accepting, allowing treatment to move beyond this issue.

Some critics believe this sort of information would be obtained anyway in the course of treatment, but whether or not this is the case, supporters of PCSOT argue that the disclosures come much earlier when polygraphy is used. There is little evidence with which to determine either of these claims.

Offenders may see the Instant Offense Exam as an opportunity to prove their 'innocence' in the face of a wrongful conviction. Although there may be a time and place for this issue to be explored, PCSOT is not it. The instant offense exam, therefore, must be used with caution.

Maintenance Exam. The Maintenance Exam is the workhorse of PCSOT. It addresses an offender's compliance with the terms and conditions of probation, parole or treatment. It is a screening test that typically covers a wide range of issues in the pre-test, following

which 3 or 4 specific questions are asked on the test itself. Maintenance Exams can address sexual thoughts and fantasies so long as they are linked to masturbatory behavior. The aims of the test are to identify behaviors indicative of increased risk so that interventions can take place, confirm when offenders are not engaging in problematic behavior, and deter offenders from engaging in risky behaviors in the first place. Its primary purpose is to prevent reoffending rather than to detect reoffenses after they have occurred.

Two examples of Maintenance Exams illustrate their potential value:

> An offender on parole license disclosed he had recently started a relationship with a young woman (one of his license conditions being that he informed his probation officer of any new relationships). Although that was the extent of his disclosure, his offender manager met with the new girlfriend and found not only that she was a single mother, but also that the offender was grooming her child in a manner similar to his instant offense. He was recalled to prison.

> An offender with a history of involvement with sex offender networks had a license condition not to associate with known sex offenders. Following a deceptive test he admitted to breaching this condition. When his probation officer later explored this with him he admitted to marked feelings of loneliness and isolation following a move from a probation hostel. Steps were taken to address his isolation, and on his next Maintenance Test he said he was no longer reliant on his former sex offender contacts and much more settled in himself; he showed no significant responses to questions relating to associating with other sex offenders.

In neither of these cases can it be demonstrated that offenses were prevented, but it would be hard to argue that the outcomes were not worthwhile.

A difficulty faced by Maintenance Tests is how to respond to a deceptive result in the absence of disclosures. Given the 10 to 20% error rate of polygraph testing it is hard to justify sanctions such as prison recall based on a failed test alone (although this does occur in some US states, it is prohibited in the UK), but a deceptive test does provide a warning sign that all may not be well. Depending on the risk represented by the offender the response could range from the probation officer addressing the issue in supervision with him, to not relaxing restrictions such as curfews or exclusion zones, to, in especially high risk cases, putting the offender under surveillance.

Maintenance Exams are carried out regularly, to set protocols – for example, in the UK they take place at 6-monthly intervals, but sooner if the offender fails a test or concerns emerge between exams. This gives rise to a risk of habituation or sensitization, resulting in fewer disclosures and false negative test results (Branaman and Gallagher, 2005). To counter this PCSOT policies usually recommend that a different examiner is introduced after a set number of tests have been undertaken. Again, however, research relating to this issue is sparse, and it is not clear the extent to which habituation occurs, or whether the suggested remedy is effective.

Monitoring Exams. Monitoring Exams are specific issue tests that take place where there is concern that an offender may have committed a new offense, or breached a license condition. As in Maintenance Tests, no sanction follows a failed test in the absence of disclosure, but a failed test may indicate the need for further investigation. On the other hand, a passed test can offer reassurance to supervisors.

The following is an example of how a monitoring exam can contribute to management:

> A 24 year old man was on parole having been convicted of unlawful sexual intercourse with a 14 year old girl. His probation officer believed he was still in a sexual relationship with his victim, but this was persistently denied by the offender, who was compliant with a night-time curfew and a tag. He denied any wrongdoing during the pre-test interview, but he was decep-

tive on the test. In the post-test interview he admitted to regular contact with the girl as well as a low level of sexual activity with her. The probation officer passed this information to the police and the offender was arrested. When interviewed by the police the girl reported regularly spending a night a week in the offender's home (a place his tag confirmed him to be), where in addition to the sexual activity he had described she said they also engaged in sexual intercourse.

Beating the test

Somewhat incongruously, the same critics who argue that polygraphy does not reliably differentiate truth telling from deception nonetheless also invariably raise the issue of countermeasures, that is, physical or psychological techniques used to manipulate responses on the test to enable examinees to appear truthful when they are being deceptive (Ben-Shakhar, 2008; London Daily Telegraph, 2012). They argue that false negative findings, whether the result of error or countermeasures, mean that 'dangerous' offenders can 'beat' the test and remain free in the community.

It is almost certainly the case that some offenders 'beat' the test, but the reality is that without polygraphy many more 'beat' their supervisors and treatment providers. For example, as referred to earlier, in the absence of polygraphy probation officers are more likely to reduce their risk assessments then they are when polygraphy is used (Grubin, 2010). Decisions, however, should not be based on polygraphy alone – PCSOT is just one part of the information package.

It is also the case that countermeasure techniques exist and can be taught, and there are a number of websites that offer to do so. But in order to be successful practice is required – theory is not sufficient, and the examinee needs feedback when attached to the polygraph (Honts et al, 1985). Most sex offenders do not have access to this type of coaching, and without it their charts usually show tell-tale signs of their attempts to manipulate the test. It should also be remembered that polygraph examiners read the same websites as their examinees.

PCSOT, treatment benefit, and risk reduction

Probation officers like PCSOT. In the English probation trials (Grubin, 2010; Gannon et al, 2014) over 90% rated polygraphy as being 'somewhat' or 'very' helpful, with very few tests considered by officers to have had either no or a negative impact. But while subjectively probation officers may believe polygraphy makes their jobs easier, this is not the same as being able to demonstrate objectively that PCSOT results in improved treatment outcome or a genuine reduction in risk (Rosky, 2012).

Evidence regarding reduction in recidivism is extremely thin, although the absence of evidence should not be confused with evidence of absence. It is difficult to carry out randomized control trials of PCSOT for a range of reasons, not the least of which is a reluctance by criminal justice agencies to 'experiment' with dangerous sex offenders. Furthermore, the low levels of recidivism that make treatment programs difficult to evaluate create similar problems for PCSOT, although significant increases in prison recall for breaches have been demonstrated (Grubin, 2010; Gannon et al, 2014).

Two early studies, although not of PCSOT per se, point in the right direction. Abrams & Ogard (1986) compared recidivism rates of 35 probationers (few of whom were sex offenders) from two counties in Oregon required to take periodic polygraph tests, with 243 offenders from a county where supervision did not involve polygraphy. Over 2 years 31% of the polygraphed men committed an offense or infringement compared with 74% of those who were not polygraphed. But the number of polygraphed offenders was small, the samples were not matched, nor is it clear whether there was selection bias in choosing those who underwent polygraphy. Also in Oregon, Edson (1991) reported that 95% of 173 sex offenders on parole or probation who were required to undertake periodic polygraph testing did not reoffend over 9 years, but there was no comparison group in this study at all.

McGrath et al (2007) carried out the one randomized trial of PCSOT in the literature, comparing 104 sex offenders in Vermont who received treatment in programs that included PCSOT with 104 matched offenders in programs where polygraphy was not used. At 5 year follow-up they found no difference in sex offense recidivism rates, but they did find a significantly lower rate of reconviction for non-sexual violent offenses. But though the study was well designed its results are difficult to interpret because while the research was sound, the way in which PCSOT was delivered was not. Offenders undertook polygraph examinations on average just once every 22 months, dissipating the likelihood that polygraphy would have much of an impact on behavior. Even so, the reduction in violent offending is notable.

In trying to determine the impact of PCSOT there is another issue to consider. It is well established in relation to sex offender interventions generally that to be effective they should adhere to the 'risk-need-responsivity' principle – that is, they should target high risk individuals, reflect treatment need, and be responsive to cognitive and cultural differences between offenders (Andrews et al, 2011). PCSOT does not tend to be delivered in this way because it is an assessment procedure rather than an intervention as such. After all, a screening technique for a medical condition is not judged on the basis of whether it improves survival rates for that condition – that is the role of what follows – but on its success in identifying at risk individuals. Expecting PCSOT to reduce recidivism may be an unreal expectation.

So how then is PCSOT to be judged? Rather than focus on recidivism perhaps attention should be focused instead on the value of the information gained as one would in an evaluation of screening instruments generally. The frequency and content of disclosures, the impact of test outcome on decision making, actions taken after a polygraph test could all form part of a cost-value analysis to determine the value added by PCSOT compared with the cost of administering it. In other words, to what extent does PCSOT better enable probation officers to monitor risk and initiate timely interventions, and are treatment targets better identified, when polygraph is used? The question then becomes, 'is PCSOT worth it?'

Internet offenders

Men who download indecent images of children from the internet present a particular challenge for those carrying out risk assessments. Typically, little is known about relevant risk factors and they often have no criminal history. It is estimated, however that around 50% of men convicted of internet offences have committed undetected sexual assaults on children, and the majority show pedophilic sexual arousal patterns (Seto, 2013). It has been suggested that applying PCSOT techniques in a preconviction setting to men arrested for downloading offenses could assist in differentiating low from high risk offenders (where risk relates to contact offending against children), enabling police resources to be better focused and criminal justice interventions to be more accurately targeted in terms of custody and treatment. That this can be done was demonstrated in a small study in which 31 apparently low risk internet offenders underwent sex history type polygraph examinations preconviction, where it was found that only 8 (26%) could be confirmed as genuinely low risk (Grubin et al, 2014). A number of police forces in England are now exploring this application of polygraphy further.

Legal considerations

The legal situation in the United Kingdom is more straightforward than it is in the United States. In the UK, the Offender Management Act 2007 sets out the statutory position regarding the mandatory testing of sex offenders on parole (Offender Management Act, 2007). Offenders must have been sentenced to a year or more in prison in order to ensure that the polygraph condition is proportionate. The legislation prohibits the use of evidence from polygraph tests in criminal proceedings, although this information can form the basis of criminal investigation, and it can also be used in civil proceedings. The Act is supported by a statutory instrument containing polygraph 'rules' which govern the conduct of polygraph sessions and sets out the requirements that must be met by examiners. The 2007 legislation mandated a time-limited period to allow mandatory polygraph testing to be evaluated on a pilot basis in a small number

of probation regions, after which the Secretary of State for Justice was required to return to Parliament for approval to extend mandatory testing nationwide. Following the successful evaluation of the pilot (Gannon et al, 2012), Parliamentary approval was granted in 2013, and mandatory testing throughout England and Wales became effective in January 2014.

Although the Offender Management Act 2007 prohibits the use of the results of mandatory testing in criminal proceedings, there is no legislation that prevents polygraph testing in general from being used as evidence in the British courts. It is sometimes claimed that case law prevents the use of polygraph evidence, but this is not true (Stockdale & Grubin, 2012). Whether polygraphy evidence should be allowed in criminal proceedings is too complicated an issue to be explored here, apart from observing that while polygraphy can be a valuable investigative tool it is not clear that it can add much to the decision making process in court.

The position regarding PCSOT in North America is more haphazard. The main issue for the courts has been whether PCSOT breaches Fifth Amendment rights against self-incrimination. In considering this question the Supreme Court ruled in McKune v. Lile that it does not, albeit in a tight 5 to 4 decision. It observed that the treatment program of which it was part served 'a vital penological purpose'. On the other hand, in United States v. Antelope (2005) the Federal 9th Circuit Appeal Court ruled that a paroled offender could not be compelled to waive his Fifth Amendment rights and take a polygraph exam with the threat of prison recall if he did not. This has made it even more necessary for programs to ensure that they properly address the self-incrimination issue, both in terms of PCSOT and more generally.

PCSOT is hardly used in Canada (McGrath et al, 2010) and it therefore does not appear to have been an issue for the Canadian courts, apart from one case where a prisoner applied for judicial review of a Parole Board decision not to release him partly on the basis that the decision was made before he had undertaken a polygraph examination – in this case the Court decided that the polygraph test results would not have changed anything in the Parole Board's decision (Aney v. Canada, 2005). In general, however, the Canadian Courts allow polygraph disclosures to be used in criminal proceedings so long as the jury is not told that they came from a polygraph test.

Ethics

Commentators rightly distinguish between practice standards and ethical principles, observing that the two do not necessarily overlap (Chaffin, 2011). Even where the delivery of PCSOT is well managed and delivered, potential ethical objections don't go away. When discussing PCSOT, a number of ethical issues are frequently raised. These tend to relate to a lack of respect for autonomy, intrusiveness, and compulsion, as well as special considerations that arise when testing special groups such as adolescents, the intellectually disabled, and individuals with mental disorder.

Some of these objections relate to a misconception of what happens in PCSOT, others to its questionable implementation. For example, Cross and Saxe (2001) refer to PCSOT as 'psychological manipulation' on the basis that examiners deceive offenders by telling them that the polygraph is error free. While this may occur, it is certainly not good practice, nor is there any reason for examiners to make out that the test is any more accurate than it actually is. Indeed, the British Psychological Society (2004) observes that participants should be informed of known error rates, a sentiment with which it is hard to disagree. There is no reason to believe that PCSOT would cease to be effective in these circumstances.

Cross and Saxe (2001), Meijer et al (2008) and Vess (2012) all argue that the test itself is based on deception when the probable lie technique is used given the hypocrisy involved in demanding the offender to be honest. Vess (2012) and McGrath et al (2010) wonder in addition what damage this might do to the therapeutic relationship. But as indicated earlier, the probable lie technique is not in fact dependent on the examinee lying even though this is what tends to be taught (indeed, as referred to above other critics refer to this theory being deficient), but on uncertainty. Regardless, the use of 'directed lies' overcomes this

objection, and also avoids the risk of the examinee admitting to transgressions that have nothing to do with his sexual risk.

Chaffin (2011), although concerned mainly with the testing of adolescents, focuses on PCSOT 'extracting confessions' from examinees, stating, "The polygraph is fundamentally a coercive interrogation tool for extracting involuntary confessions" (p. 320). PCSOT, however, need not, and should not, involve interrogation. It is instead an interview process in which lying is explicitly discouraged. The questions asked during PCSOT are asked by assessors and treatment providers anyway – the fact that PCSOT encourages disclosure of information relevant to treatment and risk management is in itself not an ethical issue.

Mandatory PCSOT is of course coercive in that there are penalties for non-cooperation. But PCSOT examinees are convicted offenders, who by virtue of their criminal convictions are required to accept a range of restrictive and coercive measures such as conditions on where they live, limitations on employment, curfews, and treatment requirements. Indeed, the European Court of Human Rights has ruled that penile plethysmography (a technique in which penile arousal in response to sexual stimuli is measured and recorded) can be made a compulsory part of sex offender treatment on the grounds of public safety (Gazan, 2002); one might think this considerably more 'invasive' than polygraphy. Provided that the questions asked during the polygraph test are directly relevant to treatment or supervision, the process does not seem any more coercive then these other measures, or any more morally problematic.

Another objection to PCSOT is that it carries with it the implication that sex offenders are not to be trusted, and that this itself damages the relationship between supervisors and offenders. There is no evidence, however, that this is the case, while what evidence there is suggests it does not (Grubin, 2010). Indeed, this implication is often implicit in any case. One should not underestimate the benefits of an offender being able to demonstrate that he is being truthful in his dealings with those supervising him, and the positive impact this can have on the therapeutic relationship.

There remains the question, however, of special groups. About half of adolescent treatment programs in the United States, for example, incorporate PCSOT (McGrath et al, 2010), and the American Polygraph Association PCSOT model policy allows for testing juveniles down to the age of 12. As Chaffin (2011) points out, given the increased vulnerability of juveniles and adolescents to coercion and suggestion, and differences in the way that risk, treatment and rehabilitation are conceptualised in this group, one can't assume that PCSOT approaches are appropriate for them. He could have added that it is not even clear that polygraphy itself works in the same way as it does in adults given differences in brain maturity and psychological development, and that the American Polygraph Association age threshold appears arbitrary. Because of these and similar issues mandatory polygraph testing in the UK does not apply to offenders who are under the age of 18.

Does this mean that polygraph testing of those under 18 is unethical? Testing offenders younger than 18 has its advocates (Jensen et al, 2015). Even Chaffin (2011), who considers the ethical concerns to be "substantial," doesn't go that far, although his view is contingent on the ability of those supporting its use in this group to prove that it provides more benefit than harm. Unless and until this evidence is produced, however, it probably makes sense to use PCSOT with great caution with those under 18, with decisions made on a consideration of individual cases rather than based on a blanket policy of PCSOT for all.

In terms of other special groups, such as those with intellectual disability and mental disorder, the position is similar. PCSOT has the potential to be of benefit, but caution needs to be used, by examiners who are aware of the pitfalls.

Finally, one might ask whether it is unethical not to use PCSOT in the treatment and supervision of sex offenders. If the information obtained during polygraph examination adds significantly to what is otherwise known about treatment need and risk, is it right to deny the potential benefits of PCSOT to an offender? When asked, many offenders themselves reported that they find polygraph testing to be helpful (Grubin & Madsen, 2006;

Kokish et al, 2005). If PCSOT does reduce risk, how can one explain to a future victim why it did not form part of the offender's treatment and supervision package?

Conclusion

Does PCSOT increase community safety? Does it enhance sex offender treatment? Although the evidence is supportive, the benefits of PCSOT have yet to be conclusively demonstrated. Objections made by many of its critics, however, are based on opinion rather than fact. But what would count as definitive evidence? For ideological reasons some will never be convinced.

Given the complexity of sex offender management, simply collecting data on numbers of disclosures, reconvictions, and the like will tell us little more than we already know. More thought needs to be directed to which offenders are most likely to benefit, the needs that PCSOT should target in those offenders, and whether modifications are necessary depending on the characteristics of the individual taking part. In other words, consideration should be given to how the 'risk-needs-responsivity' principle can be made to apply to PCSOT.

In the meantime, those who deliver PCSOT need to ensure that examiners are properly trained and supervised, protocols for the process are sound, and good quality control procedures are in place. In turn, those who make use of it must know the right questions to ask of it, how much weight to give its results, and how to integrate it with everything else they do with an offender. It should not be forgotten, however, that PCSOT remains just one tool in the box, and like any tool if it is not used with care it can cause harm.

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Impact of Interview Route Maps: Single Examiner Case Study

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Abstract

Interview Route Maps (IRMs) are visual aids that can be used to represent topical coverage of relevant questions in a polygraph examination. They are simple box and line schematics using words that encompass the elements of a given relevant question. These tools can be implemented during the question review process, prior to data collection. In the current project, performance by a single polygraph examiner was tallied, using 200 pre-employment polygraph examinations, both before and after implementation of multiple procedural changes to include additional follow up questions in a pretest interview booklet, slight modification of relevant questions, and introduction of IRMs. Following these procedural changes, the proportion of new information arising from the polygraph process increased from .215 to .410. Due to the fact that multiple variables were changed across the samples, it is impossible to determine the precise increase of reportable information afforded by IRM use. However, this case study provides initial evidence that IRM use may represent a potential element in this increase.

Introduction

Public information reveals that polygraph screening is allowed in the screening of United States Government, state and local level employees, and for national defense purposes (29 U.S. Code Chapter 22 § 2006 – Employee Polygraph Protection Act), representing a wide and pervasive context of application. The National Academy of Sciences (2003) provided a negative assessment of polygraph screening. One specific concern raised by this report was the fact that there were not specific or known behaviors addressed by the screening questions. In other words, there are no known foci of investigation with such tests. The report indicated that lower accuracy rates could be expected for screening examinations versus criminal incident examinations because the former examinations were more ambiguous for examinees than the latter. Such concerns represent considerable challenges, given the extensive application of screening polygraphs. This concern is reasonable, considering that criminal incident examinations include relevant questions that pertain to a known act or crime, while screening examinations encompass broad issues, such as criminal behaviors and acts pertaining to national security issues (Department of Defense Polygraph Institute, 2006).

One approach to address this concern of ambiguity within polygraph screening takes the form of Interview Route Maps (IRMs). The IRM term was first coined by Milne and Bull (1999) and took the form of a cognitive aid in an investigative interview. Other researchers have developed and used visual schematics to assist in encoding and learning information (Buzan, 1991; Tolman, 1948). Additional work has demonstrated that visual use of diagrams show significant improvements in comprehension and understanding, relative to when only text or verbal approaches are used (Butcher, 2004; Carlson, Chandler, & Sweller, 2003; Clarke, Flaherty, & Yankey, 2006).

These IRMs provide a natural solution to address the breadth and ambiguity repre-

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The views expressed in this article are those of the authors, and do not necessarily represent the opinions of the San Diego Police Department, the U.S. Government or the Department of Defense.

sented by polygraph screening questions, providing a visual reference for broad-reaching relevant question discussion and clarification. Examples of these box and line schematics can be found in Appendix 1. Given that a large amount of neural resources are devoted to visual information processing, in comparison to auditory information processing (Grady, 1993), it is reasonable to expect that these visual tools will help to define question parameters more clearly. In addition, the research cited previously suggests a robust effect for enhancing comprehension and understanding, which, by logical extension, should help to reduce ambiguity associated with relevant questions in polygraph screening.

A primary purpose of this case evaluation was to evaluate the impact of including the IRMs included in Appendix 1 into the polygraph screening process. Four points need to be addressed from the outset. First, IRMs were not the only variable that changed in this case study. Minor wording changes were applied to the relevant questions, though the substantive content of the questions remained constant. In addition, other changes were made to a booklet used in the pretest interview prior to the data collection process. Ultimately, it needs to be made clear that any outcomes observed before and after implementation of the changes to be described subsequently cannot be solely attributed to the introduction of the IRMs into the process.

Second, outcomes for this case evaluation will be derived from screening polygraph examinations. In this context, it is impossible to assess ground truth, or the actual disposition of any examinee, whether truthful or deceptive. Therefore, more attractive polygraph outcomes, such as accuracy cannot be applied or assessed. Third, only one set of decision outcomes was assessed, so that no index of polygraph reliability could be calculated. Finally, the application of the IRMs took place in the pretest, only during the relevant question review and were not used as visual stimuli during the data collection process.

Method

Cases and Polygraph Examiner

Two-hundred Pre-Employment polygraph reports conducted in 2014 by one examiner were reviewed. These exams were conducted between January 2014 and November 2014, and represented an exhaustive sample. The polygraph examiner was employed by a law-enforcement agency located on the West Coast of the United States, and was not one of the authors.

Initial Sample Procedures

The exams were Directed Lie Screening Tests (DLSTs) (Handler, Nelson, & Blalock, 2008; Nelson, 2012) scored with the Empirical Scoring System (ESS) (Handler, Nelson, Goodson, & Hicks, 2010; Nelson, Handler, Shaw, Gougler, Blalock, Russell et al., 2011; Robertson, 2014; many others). No Significant Response (NSR) decisions were rendered if a value of +1 or greater subtotal (overall vertical spot score) was produced for all relevant questions and Significant Response (SR) decisions were rendered if a value of -3 or lower subtotal was produced for any individual relevant question. The following target questions were included:

> R1 - Are you now concealing any theft from where you have worked?
>
> R2 - Are you now concealing your involvement with illegal drugs?
>
> R3 - Are you now concealing any unlawful sexual behavior?
>
> R4 - Are you now concealing any serious crime?

The examiner was using an interview booklet that started with the following questions about lying in the application:

> 1- Did you answer truthfully all of the questions on your Personal History Statement and Pre-Investigative Questionnaire?
>
> 2- Did you intentionally omit any information or facts that you feel may disqualify you from this position?
>
> 3- Did you add, embellish, enhance or minimize any information on any of the submitted paperwork?

Subsequent Sample Procedures

The first author was hired in October 2014 and implemented the following changes. First, a new interview booklet was introduced that separated the polygraph interview from the background questionnaire. This author thought the opening questions of the interview placed emphasis on whether applicants were truthful on the application. It was theorized that examinees would be more willing to provide previously denied information if the interview would start with an appeal that encourages them to be truthful regardless of what they had provided prior to the polygraph session. This interview booklet included the following changes:

a)Appeal for examinees to be truthful.

b)Did not ask if examinees lied on any previously given information.

c)Covered and went beyond questions asked in their background questionnaires.

d)Attempted to isolate responsibility only for acts they committed (Handler et al., 2009).

Second, new target questions were introduced with multiple modifications. The word "concealing" was eliminated in exchange for direct questions (e.g., "Have you ever…"). The rationale was the belief that examinees would not admit to every single transgression pertaining to a single target. In addition, target areas were introduced that included predictive qualities (Aamodt, 2004; Handler et al. 2009):

R1 – As an adult, have you had any (other) formal discipline at work?

R2 – As an adult, have you had any (other) personal involvement with illegal drugs"

R3 – Have you ever committed any (other) serious crime?

R4 – Have you ever committed any (other) sex crime?

A related caveat was also included relative to question R2. An adult is defined as being 18 years old. Due to Agency policy, applicants over 28 years were asked 'In the last 10 years' for the drug question. In addition, physical acts of violence is defined as a serious crime.

Third, visual mind maps or IRMs were used to define target questions. These tools provide a visual reference for question discussion and clarification. Given that a large amount of neural resources are devoted to visual information processing, in comparison to auditory information processing (Grady, 1993), it is reasonable to expect that these visual tools will help to define question parameters more clearly. The IRMs used in the subsequent sample are contained in Appendix 1.

Finally, care and deliberation was taken to ensure that all words in questions were clearly defined. For example, 'other' was defined as 'besides what you have told me' and 'you' was defined as 'what you have done, not your friends, family, etc.'

After implementation of these changes, an exhaustive sample of 200 reports were examined from the same examiner, spanning from January 2015 to October 2015. Thus the results of these 200 reports were compared to an exhaustive sample of 200 reports prior to implementation of these changes, for a total of 400 reports examined.

Results

Defining Outcomes

An *Inconclusive* result indicated that hand scores did not reach the threshold for an NSR or SR decision. A *No Opinion* result reflected artifacts or unstable data. In other words, the examiner perceived the data was not clear enough to be analyzed due to artifacts, including movements, breathing distortions, etc. Countermeasure results reflected obvious attempts on the part of the examinee to manipulate the test outcome. New information reflected information gained from the pretest interview. This might include information relating to previously denied questions, elaborations on previously disclosed information, and/or criminal behavior, including drug in-

volvement, and questions regarding the character of the applicant (work history, current frequency of intoxication, etc.). Finally, Repetition Required indicated that the polygraph examiner had to repeat a subtest to reach an outcome. Table 1 shows the frequencies produced by the polygraph examiner before and after implementation of the new training.

Table 1. Outcomes as a function of initial and subsequent sampling.

	Initial Sample	Subsequent Sample
No Significant Response	112 (.560)	118 (.590)
Significant Response	55 (.275)	55 (.275)
Inconclusive	13 (.065)	5 (.025)
No Opinion	14 (.070)	10 (.050)
Countermeasures	6 (.030)	12 (.060)
New Information	43 (.215)*	82 (.410)*
Repetition Required	53 (.265)	50 (.250)

Note. * Statistically significant difference.

Proportion tests (Bruning & Kintz, 1987) were used to assess differences between the initial and subsequent samplings. The difference in new information between the initial and subsequent sample reached statistical significance, $Z = -4.21$, $p < .0001$. The difference in the proportion of inconclusive decisions was marginally significant, $Z = 1.93$, $p = .0537$. No other differences were statistically significant (all ps > .140).

Discussion

Evidence from the present project suggests that among other modifications (i.e., changes to relevant questions and change to pretest booklet), the use of IRMs produced a significant increase in the amount of information elicited in the pretest interview. No other significant differences were produced, suggesting that implementation of IRMs will not detrimentally impact screening polygraph results decision outcomes.

A key element from the present study is an explanation as to what caused the increase in reportable information in the subsequent sample. Without the luxury of debriefing interviews on polygraph examinees, any explanation is tantamount to conjecture. That being said, one possibility is the visual representation of the elements demonstrated in each IRM may have made it more difficult for examinees to gloss over or rationalize their way out of their previous behaviors during pretest or posttest interviews, ultimately leading to more forthcoming behavior. Again, without additional data, this explanation cannot be substantiated.

Once again, it should be clearly understood that other changes to the testing booklet and relevant questions were also rendered over the course of this project. The outcomes assessed in this case study could not address accuracy performance, given the inherent difficulty in determining ground truth in screening examinations. This study represents value from an ecological validity standpoint, given

that it is a field study with real world stakes and jeopardy for the examinees. However, it suffers in this same respect, given that it captures performance from only one polygraph examiner, which of course limits generalizability to the population of polygraph examiners.

Based on these results it is recommended that IRMs be added as a standard component to screening polygraph examinations, and that further research into their use be conducted. Sprinkled with the caveats addressed previously, IRMs appear to be a component of the polygraph screening process that can afford significant increases in the utility of the screening polygraph process. It is highly recommended that the impact of IRMs on polygraph examinations be assessed in laboratory studies where more definitive performance results such as accuracy can be evaluated. In addition, such contexts may allow for the identification of explanations for increases in disclosures against self-interest. Finally, future work in this area should involve carefully designed studies that allow for the clear assignment of causality as a function of the presence or absence of the IRMs in isolation, as opposed to the confounded assessment in the present study.

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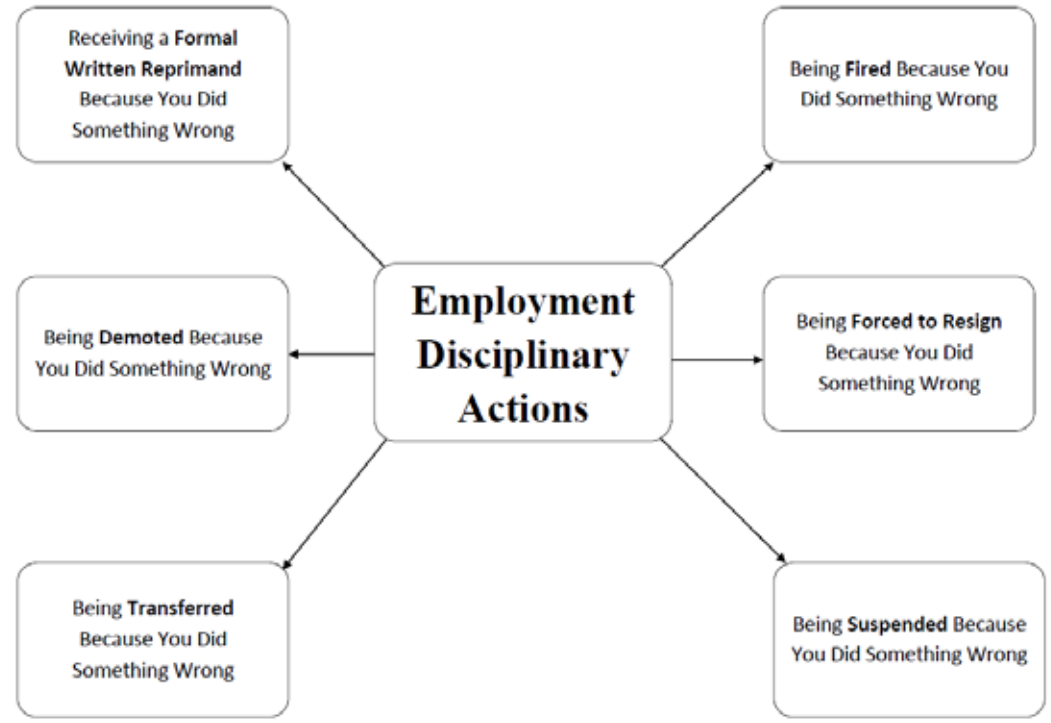
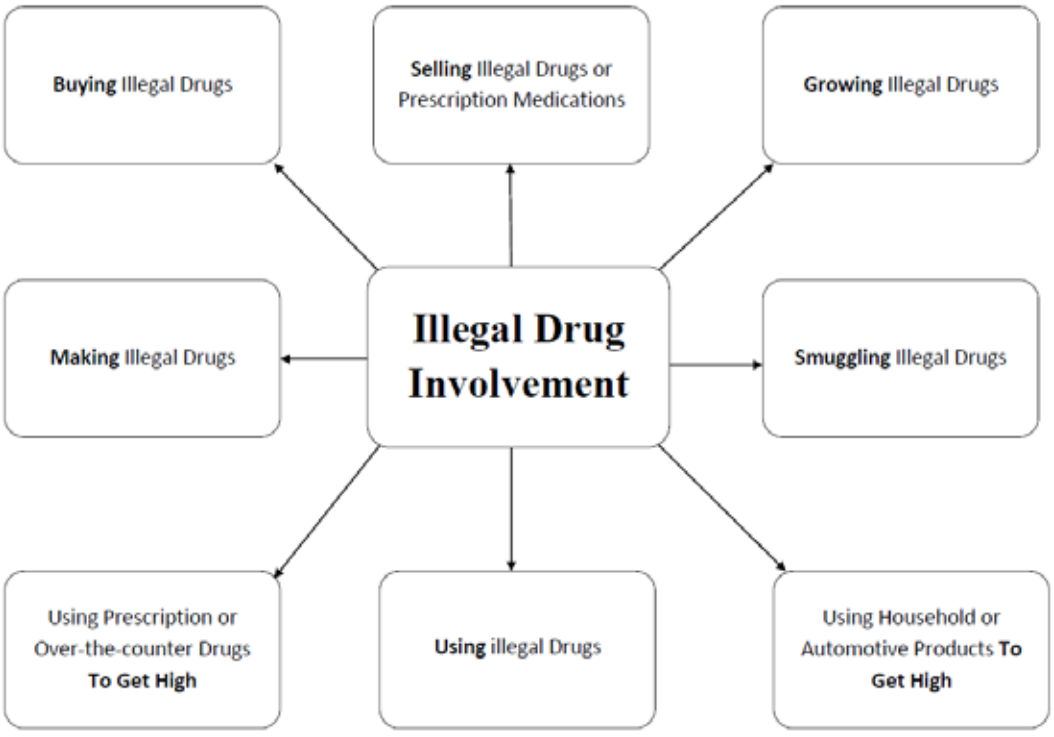
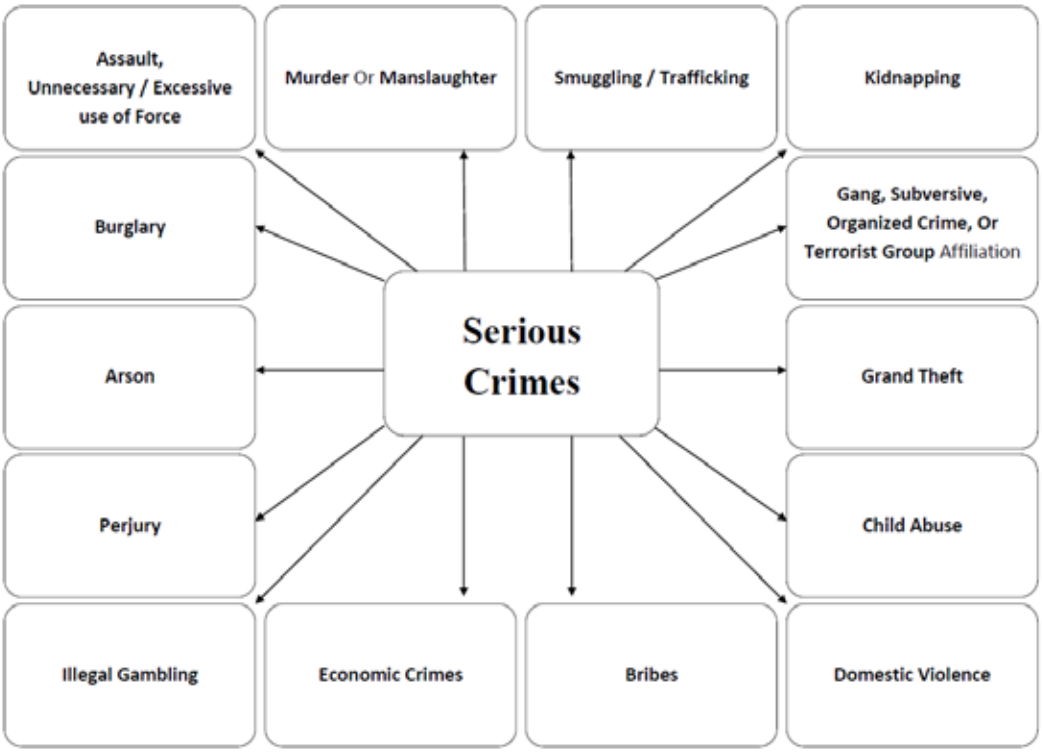
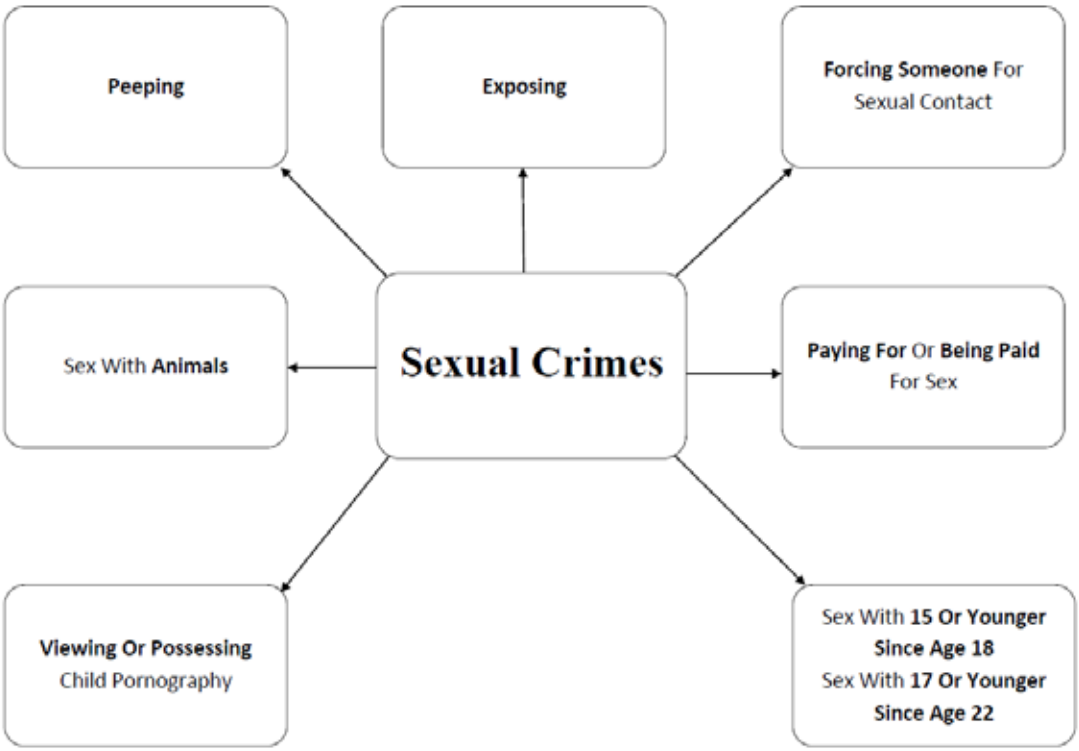
Appendix 1


Employment Disciplinary Actions
Receiving a **Formal Written Reprimand** Because You Did Something Wrong
Being **Fired** Because You Did Something Wrong
Being **Demoted** Because You Did Something Wrong
Being **Forced to Resign** Because You Did Something Wrong
Being **Transferred** Because You Did Something Wrong
Being **Suspended** Because You Did Something Wrong


Illegal Drug Involvement
Buying Illegal Drugs
Selling Illegal Drugs or Prescription Medications
Growing Illegal Drugs
Making Illegal Drugs
Smuggling Illegal Drugs
Using Prescription or Over-the-counter Drugs **To Get High**
Using illegal Drugs
Using Household or Automotive Products **To Get High**


Assault, Unnecessary / Excessive use of Force
Murder Or Manslaughter
Smuggling / Trafficking
Kidnapping
Burglary
Gang, Subversive, Organized Crime, Or Terrorist Group Affiliation
Serious Crimes
Arson
Grand Theft
Perjury
Child Abuse
Illegal Gambling
Economic Crimes
Bribes
Domestic Violence


Peeping
Exposing
Forcing Someone For Sexual Contact
Sex With Animals
Sexual Crimes
Paying For Or Being Paid For Sex
Viewing Or Possessing Child Pornography
Sex With 15 Or Younger Since Age 18
Sex With 17 Or Younger Since Age 22

The Holden Applicant Reliability Measure as a Tool for Detecting Deception

Angela Book [a*], Ronald R. Holden [b], Ashley Hosker-Field [a], Nathalie Gauthier [a], & Tabitha Methot [a]

Abstract

Two studies evaluated the utility of the Holden Applicant Reliability Measure (HARM; Holden, 2000) as an integrity measure for use in personnel selection. Because there is the risk of faking with overt tests, such as the HARM, we administered the test via computer, which has been shown to reduce the tendency for socially desirable responding (Vereecken & Maes, 2006). The HARM is a 100-item instrument measuring counterproductive employee behaviors, such as alcohol and drug use, absenteeism, and unauthorized resource usage. Respondents answer true or false to each item. In Study 1, 300 undergraduate participants completed the computer-administered HARM twice; once honestly, and once attempting to appear as well-adjusted as possible without being caught faking. Participants in Study 2 were individuals employed, seeking employment, or interning at Latin American Polygraph Institute in Columbia. As hypothesized, both studies found that HARM subscale scores differed significantly between honest and faking administrations. More specifically, all counterproductive behaviors were underreported in the faking conditions. Logistic regression analysis was conducted to determine whether the combination of HARM subscales accurately predicted the instructions to fill out the measure honestly or to fake good in order to maximize chances of employment. In both samples, the predictive utility of the HARM was found to be good to excellent. The findings suggest that the HARM is a useful measure for establishing prospective employee integrity/reliability. Counterproductive behaviors were also found to be negatively correlated with personality scales of Honesty-Humility, Agreeableness, and Conscientiousness, as measured by the HEXACO-PI-R (Lee & Ashton, 2004).

Keywords: integrity testing; personnel selection; HARM; HEXACO

Counterproductive behaviors in the workplace are both difficult to detect, and extremely costly to organizations (Ryan & Sackett, 1987), with cost estimates being in the range of billions of dollars per year (Hefter, 1986). For example, substance use by workers has been shown to be related to increased absenteeism and turnover (Normand, Salyards, & Mahoney, 1990), as well as accidents, medical costs, and worker compensation claims (Lehman & Simpson, 1992). Due to the impact of counterproductive behaviors on organizations (especially large financial implications), selection tests that evaluate employee integrity and/or honesty have become an important part of personnel selection procedures. Such tests of integrity have been developed and administered in order to reduce the cost associated with counterproductive behaviors (Hogan & Hogan, 1989; Wanek, 1999). Integrity tests are often administered during pre-employment screening (Ryan & Sackett, 1987), and the use of such tests has been increasing in popularity since the 1980s (Rudner, 1992; Sackett, 1994). Rudner reports that initial results of research were promising in that screening with integrity testing does appear to improve employee productivity under certain conditions. First, the integrity test needs to be implemented properly. Further, the test must have empirically demonstrated validity and reliability. Finally, Rudner suggests that, rather than using the integrity test in isolation, such tests should only be used in conjunction with other screening procedures.

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Initially, organizations tended to utilize the polygraph to establish truth/deception in job selection contexts. These endeavors, however, met with little success, and were extremely expensive to implement within the context of personnel selection. Thus, alternatives to the polygraph were sought, and amongst them was integrity testing (Rudner, 1992). Given the ease of administration and relatively low cost, integrity testing has become a popular alternative to the polygraph.

Ones and Viswesvaran (1998) note that integrity tests were developed on general populations, making them more generalizable than clinical measures. Further, most of integrity tests are paper-pencil or computer-administered self-report measures, making them relatively inexpensive and easy to administer (Ones et al). Integrity tests were also specifically developed to predict counterproductive behaviors, and are, thus, more relevant to the workplace. Rudner (1992) suggests that a test be chosen for relevant content (i.e., to the job being applied for), giving the procedure further validity. Finally, Wanek (1999) points to the importance of choosing a test that is consistent with the company image and is appropriate for the population being tested.

Originally called "honesty testing", this type of screening is now labeled "integrity testing" (Wanek, 1999), and has also been referred to as dependability, trustworthiness, conscientiousness, or reliability testing (Sackett & Wanek, 1997). Integrity tests fall primarily into two categories. "Overt" or "clear purpose" tests ask direct questions about counterproductive behaviors in the workplace, and, therefore, make it obvious to the respondent exactly what is being measured. A second set of tests are personality-oriented tests (or "veiled purpose" tests) and these are less direct in their approach and rely on various personality traits, such as conscientiousness to predict counterproductive behaviors.

For a measure to be useful, it needs to be both reliable and valid. Previous research on the reliability of integrity testing has been promising. Ones, Viswesvaran, and Schmidt (1993) conducted a meta-analysis examining the reliability and validity of such tests. Results indicated that both types of integrity tests had high internal consistency reliability (Cronbach alpha coefficients were .82 and .77 for overt and personality oriented tests, respectively). These tests were also stable over time, exhibiting high test-retest coefficients measured between 1 and nearly 2000 days apart (adjusted coefficients were .94 and .88 for overt and personality oriented tests, respectively). The authors concluded from these findings that integrity testing meets the standards for reliability.

For a measure to exhibit validity for job selection contexts, there must be a substantial correlation with job productivity, speaking to predictive validity (Brogden, 1949; Taylor & Russell, 1939). Several meta-analyses and reviews have been conducted that support the criterion-related validity of integrity testing (e.g., Hogan & Hogan, 1989; Inwald, Hurwitz, & Kaufman, 1991; McDaniel & Jones, 1988; Ones et al., 1993). In their meta-analysis (described above), Ones et al. also examined the validity of integrity testing instruments. Effect sizes were generally medium to large for the relationship between instruments and counterproductive behaviors. Importantly, validity estimates were higher for overt tests than for personality-oriented measures. Ones et al., as such, found strong support for the validity of integrity testing in selection contexts.

A more recent meta-analysis was conducted by Van Iddekinge, Roth, Raymark, and Odle-Dusseau (2012), examining 104 studies with 134 independent samples. They also found moderate relationships between integrity tests and criterion variables, and as with Ones et al. (1993), the validity coefficients were higher for overt tests than for personality-oriented measures. It should be noted that publisher involvement in research also had an effect, with publisher data showing higher validity coefficients than independent researchers (Ones et al.). That being said, integrity tests may provide the largest increment in validity over and above cognitive testing, according to Schmidt and Hunter (1998).

Although it appears that integrity testing can be both reliable and valid, many researchers are concerned about the issue of fakability. Faking does tend to distort responding on self-report personality assessments (see Holden & Book, 2012 for a review of the research), and one might expect this to

be a problem for integrity tests as well given: a) the self-report nature of the instruments and; b) that items on overt tests ask applicants to report on sensitive issues such as drug use, absenteeism, and theft. Although integrity testing does appear to have validity (e.g. Hough, Eaton, Dunnette, Kamp, & McCloy, 1990), susceptibility to faking is a compelling concern that needs to be addressed (Holden, 1995). Some research suggests that these tests are not easily faked (e.g., Ash, 1974; Morey, 1981), however such studies typically utilize extreme groups designs, with one group being, for example, inmates, and the other being recruited from the general population.

One study that used comparable groups was conducted by Ryan and Sackett (1987). One-hundred and forty-eight students completed an honesty testing measure under 1 of 3 sets of instructions (respond honestly, fake good, or respond as if applying for a job). Participants in the "fake good" condition were asked to make themselves look better than they actually are, while students in the "job" condition were asked to answer as though applying for a job. In both conditions, it was expected that participants would enhance their good qualities and minimize their bad qualities. Students in the "applying for a job" condition responded to the items in a similar manner to the honest group. This suggests that faking in a job application context may be subtle (and thus, difficult to detect). When simply asked to "fake good", students' responses were significantly more positive than the other two conditions, which did not differ from one another. The fact that the "applying for a job" condition mirrored the honest condition suggests that these instruments are susceptible to faking; thus making it plausible to include it in the administration of the test.

One avenue for potentially reducing socially desirable responding (and faking) is to administer sensitive tests (i.e., integrity tests) via computer (Vereecken & Maes, 2006). Computer administration can be seen as less personal, less judgmental, and allow for greater privacy. Such a procedure may reduce the likelihood of biased responding on sensitive issues. Wright, Aquilino, and Supple (2001) found that adolescents were more likely to self-report substance use in computer administration than in the traditional paper-and-pencil administration. In another study, Vereecken and Maes (2006) compared computer administration and paper-and-pencil versions of the same test. In a sample of over 5,000 adolescents, mode of administration did not have a significant effect on responding, except for affect-related items, where adolescents were more likely to give socially desirable answers on the paper-and-pencil version than they were during computer administration. These findings suggest that computer administration may be useful in reducing the effect of faking on integrity tests.

In the present set of studies, we evaluated the Holden Applicant Reliability Measure (HARM; Holden, 2000) as an integrity test to be utilized in personnel selection. The HARM assesses eight dimensions of on-the-job employee counterproductivity, and is comprised of 100 true/false items. HARM subscales are Alcohol Use, Interpersonal Conflict, Unauthorized Absenteeism, Missing Deadlines, Drug Use, Unauthorized Resource Usage, Dishonesty, and Arrival Tardiness. Higher scores indicate increased problems (e.g., higher scores on alcohol use indicate increased alcohol usage). Internal consistencies for HARM subscale scores are acceptable to excellent, with all subscales having coefficient alpha reliabilities above .76, with the exception of Arrival Tardiness, which has been shown to have a coefficient alpha of .64 (Holden, 2000). In a recent study, Lambert, Arbuckle, and Holden (2016) found that the HARM significantly predicted whether participants had been asked to respond honesty versus faking-good (attempting to appear better than one actually is).

The HARM is an overt integrity test, and, therefore, items are quite obvious in what they are measuring, giving the measure face validity. Importantly, the HARM has also demonstrated construct validity in that it is related to various measures of antisocial behavior and traits, including primary and secondary psychopathy (Levenson Self Report Psychopathy Scale; Levenson et al., 1995) and social symptomatology (Holden, Starzyk, Edwards, Book, & Wasylkiw, 2003). Table 1 provides correlations between the HARM subscales and measures of antisociality for the HARM validation sample of 300 individuals who were actively seeking employment (Holden et al.). Most of the relationships are mod-

erate in strength. Given the fact that all of the relationships were significant and most were moderate indicates that the HARM effectively predicts other measures of antisocial behavior, supporting its construct validity.

The current set of studies examined the utility of the HARM to detect faking in a job application context. Study 1 was conducted with undergraduate student participants, while Study 2 was conducted with actual job applicants, employees, and students at the Latin American Polygraph Institute (and employees at private companies in Columbia) in an effort to evaluate the generalizability of findings from the first study. In general, we expected respondents to produce higher HARM scores (total and subscales) when responding honestly than when they were instructed to look as well-adjusted as possible without being caught at faking. To evaluate this hypothesis, we used a repeated-measures design with each participant filling out the HARM twice (once honestly, once faking) with order being counterbalanced. We also hypothesized that the HARM subscale scores could be used to correctly classify whether or not participants were being honest.

Although the criterion-related validity of integrity testing is well established, some research suggests that these relationships can be explained based on personality traits. For example, integrity tests appear to have a moderate correlation with conscientiousness (Barrick & Mount, 1991), which is clearly related to counterproductive behavior. Further, Marcus, Lee, and Ashton (2007) directly tested whether criterion-related validity was explainable by personality traits. The authors found that the validity of overt tests was explained best by Honesty-Humility (part of the HEXACO model of personality), while the Big Five personality traits best predicted the validity of personality-oriented measures. Because personality (particularly as measured by the HEXACO) appears to be an important aspect of construct validity in the context of integrity testing, we examined the construct validity of the HARM in terms of its correlations with basic personality traits, as measured by the HEXACO (Lee & Ashton, 2004). The HEXACO has three factors that directly map onto traits measured by the Big Five: a) Extraversion (X; tendency to be confident, sociable, and energetic vs. unsociable, lack of liveliness and positivity), b) Conscientiousness (C; tendency to be organized, disciplined, and deliberative vs. careless, impulsive, and disorganized) and; c) Openness to Experience (O; tendency to be inquisitive, imaginative, and absorbed in art and nature vs. conventional, uncurious, and disinterested in aesthetic characteristics). Two of the other HEXACO factors are similar to their Big Five counterparts; Emotionality (E; tendency to be fearful, anxious, empathetic and sentimental vs. unworried, emotionally detached from others, and fearless) and Agreeableness (A; tendency to be forgiving, cooperative, and even-tempered vs. angry, unforgiving, and critical of others). These factors are rotated versions of Big Five Neuroticism and Agreeableness, respectively. The final HEXACO factor (Honesty-Humility (H)), however, measures fairness, sincerity, greed avoidance, and modesty, which is not captured by the Big Five factors. It is unsurprising then, that HEXACO personality, assessed with the HEXACO Personality Inventory (HEXACO-PI-R; Lee & Ashton, 2004) has been shown to outperform the Big Five in accounting for behaviors related to dishonest and manipulative (and, conversely, honest and cooperative) behaviors (e.g., Lee, Ashton, Morrison, Cordery, & Dunlop, 2008; Lee et al., 2013; Lee, Gizzarone, & Ashton, 2003). Given these findings, we hypothesized that Honesty-Humility would be related to HARM subscale scores, in that people higher on H are less likely to engage in negative behaviors in the workplace. As well, Agreeableness and Conscientiousness have obvious theoretical links to workplace behavior. People high on Agreeableness are less likely to have interpersonal conflicts, for example, and people high on Conscientiousness should be more concerned with behaving properly in the workplace, thus engaging in fewer negative workplace behaviors. We had no expectations for Emotionality, Neuroticism, or Openness.

Method

Participants

Sample 1. Three hundred undergraduate students were recruited through a psychology research participant pool at a Canadian university (mean age = 21.93 years, *SD* = 1.34).

Sample 2. Participants for this sample were 156 students, employees, and referrals of the Latin American Polygraph Institute, as well as employees of private companies in Columbia. The sample consisted of 86 men and 70 women, aged 17 to 59 years (M = 32.36, SD = 10.11).

Materials. The Holden Applicant Reliability Measure (HARM; Holden, 2000), described in detail above, was administered to participants in the present study. For Study 2, where participants' first language was Spanish, the HARM was translated into Spanish by a native Spanish speaker, and was tested out on a pilot sample to ensure that the wording was appropriate. For both studies, HARM scores were transformed into T-scores.

HEXACO. The 100-item version of the HEXACO-PI-R (Spanish translation; Ashton & Lee, 2004) was used to assess six personality factors: Honesty-Humility, Emotionality, Extraversion, Agreeableness, Conscientiousness, and Openness to Experience. Participants responded to items on a five-point scale from 1 (*strongly disagree*) to 5 (*strongly agree*).

Procedure

Study 1

Participants were instructed to complete the HARM twice, once under instructions to answer honestly, and once under instructions to maximize the possibility of being selected as part of a personnel selection process. Order of administration was counterbalanced to control for order effects. Half of the participants filled out the questionnaire honestly first, while the other half completed the HARM under deceptive conditions first. The HARM was computer-administered given the obvious and sensitive nature of the questions, in an attempt to reduce the susceptibility to faking (Vereecken & Maes, 2006). For the condition maximizing selection, instructions were as follows:

> NOW, PLEASE READ THE FOLLOWING INSTRUCTIONS TWICE
>
> For the next questionnaire, assume that you are in a situation where it would benefit you greatly to appear very well adjusted. Therefore, please respond so that you present yourself as someone without psychological problems or personality faults. In other words, try to fake the questionnaire so that the results will show that you are better than you really are. Although you may feel that you would never represent yourself dishonestly, please try to do so for this research study. However, beware that the questionnaire has certain features (which you want to avoid) designed to detect "faking". Do your best to fake out the questionnaire.

Study 2

In Study 2, the participants underwent the Study 1 procedure (using a Spanish translation of the HARM), and also completed the HEXACO-PI-R (Spanish Form; Lee & Ashton, 2004).

Results

Study 1

Because the current study utilized a repeated-measures design (participants filled out the HARM under two different sets of instructions), we first wanted to determine whether participant responses differed between the two administrations. All paired samples t-tests were significant (see Table 2). Thus, participants in the truthful conditions responded differently than those in the deceptive conditions. More specifically, all subscale scores were higher in the honest administration.

To determine whether HARM scores could correctly classify honest versus faking instructions, we conducted two logistic regression analyses. In the first analysis, , we used the honest responses from half of the sample (n = 150) and the deceptive responses from the other, distinct half (n = 150) of the total sample. Complementarily, the second logistic regression used the deceptive answers from the former half (n = 150) of the sample, and the honest responses from the latter half (n = 150) of the sample. In these analyses, all HARM

subscales scores were used to classify whether a respondent had been answering honestly or faking.

Both logistic regressions were statistically significant, χ^2 (7) = 177.29, $p < .001$, and χ^2 (7) = 270.72, $p < .001$, indicating that the HARM subscales together predicted whether participants were in the honest condition or had been asked to maximize chances of employment. Sensitivities were excellent (93% and 95%) for both analyses, and specificities were very good to excellent (80% and 85%, respectively). Overall accuracies were also excellent (87% and 89%, respectively). Absenteeism, Unauthorized Resource Usage, Dishonesty, Arrival Tardiness, and Interpersonal Conflict subscales all significantly contributed uniquely to predicting instruction condition (honest vs. faking; $p < .05$).

The above analyses indicate that the HARM can be a valuable tool in personnel selection contexts, but a cutoff T-score is necessary in order to apply it to real situations and individuals. Based on the above analyses, we recommend using an average T-score of 42 (and lower) as an indicator of faking. Using an average T-score of 42 resulted in a sensitivity of .97 and a specificity of .99.

Study 2

Because Study 1 was conducted using an undergraduate sample, Study 2 used a broader sample of employees, potential employees, and student interns at the Latin American Polygraph Institute in Columbia. As in Study 1, we used a repeated-measures design with participants completing the HARM under two sets of instructions. HARM subscale scores were again significantly higher in the honest condition, as can be seen in Table 3.

Our second objective was to determine whether we could classify respondents as responding honestly versus faking good using HARM scores. To examine this logistic regression analyses were again applied. In the first logistic regression, we used the honest responses from one half of the sample and the deceptive responses from the other, distinct half of the total sample. In the second, we used the deceptive answers from the first half of the sample, and the honest responses from the second half. HARM subscale scores were entered as predictors, with instructional condition being the dependent variable.

As in Study 1, both logistic regressions were statistically significant, χ^2 (7) = 140.34, $p < .001$, and χ^2 (7) = 125.72, $p < .001$, indicating that the HARM subscales together predicted whether participants were in the honest condition or had been asked to maximize chances of employment. Sensitivities (83% and 79%), specificities, (72% and 75%), and overall accuracies (78% and 77%) were relatively high, mirroring the results from Study 1. Unauthorized Resource Usage, Dishonesty, and Arrival Tardiness subscales were all significant contributors to predicting of instructional condition (honest versus faking; $p < .001$).

As in Study 1, we determined that an average T-score of 42 should be used as a cutoff for faking on the HARM. Average T-scores of 42 or below produced a sensitivity of 1.00 and a specificity of 1.00.

Construct Validity of the HARM

Our final hypothesis was that HARM subscales would be negatively related to scales of Honesty-Humility, Agreeableness, and Conscientiousness (as measured by the HEXACO; Lee & Ashton, 2004). As can be seen in Table 4, relationships between the HARM and HEXACO subscales were relatively consistent, whether looking at the truthful scores or the deceptive scores. Under Honest instructions, Honesty-Humility was negatively correlated with Unauthorized Resource Usage and Dishonesty, while in the Deceptive condition, it was related negatively to Interpersonal Conflict and Dishonesty. Under Honest instructions, Agreeableness was negatively related to Interpersonal Conflict, Unauthorized Absenteeism, Unauthorized Resource Usage, Dishonesty, and Arrival Tardiness. Similarly, under Faking instructions, Agreeableness was negatively associated with both Interpersonal Conflict and Dishonesty. Conscientiousness was associated with Interpersonal Conflict, Dishonesty, and Arrival Tardiness, but only under Faking instructions. Interestingly, Arrival Tardiness scores were also negatively related to Extraversion and Openness under Faking instructions.

Discussion

The purpose of the present study was to evaluate the HARM (Holden, 2000) as a tool for assessing the integrity of prospective employees during screening procedures. As hypothesized, participants in both samples had significantly higher scores on all subscales when answering the instrument honestly than when attempting to appear well-adjusted. That is, participants tended to underreport the extent to which they engaged in various counterproductive workplace behaviours when instructed to respond in a way that would make them appear better than they really are. The clear distinction between individuals' scores in the current research implies that subtle faking was not an issue , in spite of instructions that implied the ability to detect faking. Previous research has, in fact, found that subtle faking does tend to be a problem in job application scenarios (Ryan & Sackett, 1987), but biased responding is reduced when questionnaires are computer administered (Vereecken & Maes, 2006; Wright, Aquilino, & Supple, 2001). As such, our decision to use the computer administered HARM appears to have lessened the problem of "subtle" faking, showing large differences in scores between honest and faking administrations. That being said, we did not directly compare computer administration to traditional paper/pencil administration.

The subscales of the HARM predicted whether an individual was answering honestly or faking good in both student and field samples. That is, the HARM subscale scores combined to predict whether or not the participant was responding to maximize their suitability as an applicant (specifically, attempting to appear well-adjusted). Using a cutoff T-value of 42, we were able to correctly classify 97 to 100% of participants. This finding aligns with previous research on integrity testing. A number of reviews and meta-analyses support the reliability (e.g. Ones et al., 1993) and validity of integrity testing, especially for overt integrity tests (Hogan & Hogan, 1989; Inwald, Hurwitz, & Kaufman, 1991; McDaniel & Jones, 1988; Ones et al., 1993; Van Iddekinge, Roth, Raymark, & Odle-Dusseau, 2012), with validity coefficients tending to be medium to large in size.

Further, in the field study, we found that HARM subscale scores were correlated with expected personality traits, as measured by the HEXACO. Under Honest instructions, Honesty-Humility was negatively correlated with Unauthorized Resource Usage and Dishonesty, while in the Deceptive condition, it was related negatively to Interpersonal Conflict and Dishonesty. Under Honest instructions, Agreeableness was negatively related to Interpersonal Conflict, Unauthorized Absenteeism, Unauthorized Resource Usage, Dishonesty, and Arrival Tardiness. Similarly, under Faking instructions, it was negatively associated with both Interpersonal Conflict and Dishonesty. Conscientiousness was associated with Interpersonal Conflict, Dishonesty, and Arrival Tardiness, but only under Faking instructions. Interestingly, Arrival Tardiness scores were also negatively related to Extraversion and Openness under Faking instructions. The findings for Honesty-Humility, Agreeableness, and Conscientiousness are in agreement with previous research findings that indicate these traits are related to antisocial behaviors (Lee, Ashton, Morrison, Cordery, & Dunlop, 2008; Lee et al., 2013; Lee, Gizzarone, & Ashton, 2003).

Results indicate that the HARM would be a valuable tool in personnel selection contexts. There is a clear difference in HARM scores between honest and faking administration, and the HARM scales accurately distinguish between honest and deceptive conditions. Because counterproductivity has a large impact on both organizations and society (Lehman & Simpson, 1992; Normand, Salyards, & Mahoney, 1990; Hefter, 1986), it is important to have such tools available. Additionally, integrity testing seems to have a positive impact on employee productivity under certain conditions, including using a measure that is both reliable and valid (Rudner, 1992).

Limitations of the Study

The present set of studies may have some potential limitations. First, because participants in Study 1 were undergraduate students, the results of that study may not generalize to samples of individuals who are actually seeking employment. That being said, the original validation study (Holden, 2000) was conducted with individuals who were

seeking employment, bolstering the reliability of the findings. Study 2 was conducted using a sample of potential and actual employees/interns, where the findings from the first study were replicated, confirming the utility of the HARM in real-world applications.

Although the results of the computer-administered HARM are compelling, we did not directly examine the difference between computer and traditional administration. Future research should be designed to directly compare the two administration modes.

Future Research

There are a number of research questions that will be important to investigate in future research. For example, while we did examine the construct validity of the HARM using HEXACO personality variables, researchers should examine how HARM scores relate to workplace behaviors in an employment context. Related to this, there should be attempts to examine the use of the HARM to determine integrity in various employment contexts, including law enforcement and private sector companies.

As well, Rudner (1992) states that for integrity testing to be useful, it should not conducted in isolation. Therefore, future studies should examine the utility of the HARM when it is administered as part of a larger selection package, including personality and cognitive abilities measures.

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Table 1. Criterion-related validity coefficients for the HARM (from Holden et al., 2003)

	Primary Psychopathy	Secondary Psychopathy	Total Psychopathy	Social Symptomatology
HARM Scale				
Alcohol Use	.18	.18	.21	.26
Interpersonal Conflict	.34	.26	.36	.42
Unauthorized Absenteeism	.16	.21	.21	.28
Missing Deadlines	.22	.26	.27	.19
Drug Use	.22	.19	.24	.33
Unauthorized Resource Usage	.18	.20	.22	.33
Dishonesty	.33	.34	.39	.38
Arrival Tardiness	.17	.21	.21	.24
HARM Total Score	.36	.38	.42	.49
Employee Misdemeanors	.29	.34	.36	.41
Workplace Antisociality	.34	.29	.37	.44
Average Correlation	.25	.26	.30	.34

Note. Values are correlations and all are significant at the .05 level.

Table 2. Study 1: Descriptive statistics and paired samples t-tests for HARM subscales.

Variable	Condition	T-score	*SD*	*t*	*p*
Alcohol Use	Honest	49.86	9.90	6.55	< .001
	Deceptive	45.87	3.95		
Unauthorized Absenteeism	Honest	49.97	10.00	18.56	< .001
	Deceptive	39.18	2.45		
Missing Deadlines	Honest	50.00	9.99	10.16	< .001
	Deceptive	43.58	5.56		
Drug Use	Honest	50.01	10.07	3.88	< .001
	Deceptive	47.75	0.00		
Unauthorized Resource Usage	Honest	50.03	10.01	13.96	< .001
	Deceptive	41.67	4.81		
Dishonesty	Honest	50.00	9.99	17.19	< .001
	Deceptive	39.90	3.30		
Arrival Tardiness	Honest	51.99	9.99	3.32	.001
	Deceptive	49.95	4.31		
Interpersonal Conflict	Honest	50.02	10.02	9.98	< .001
	Deceptive	44.23	3.56		

Note. $N = 300$.

Table 3. Study 2: Descriptive statistics and paired samples t-tests for HARM subscales.

Variable	Condition	T-score	*SD*	*t*	*p*
Alcohol Use	Honest	46.59	4.69	3.83	< .001
	Deceptive	45.19	1.47		
Unauthorized Absenteeism	Honest	43.23	5.00	5.52	< .001
	Deceptive	41.02	1.05		
Missing Deadlines	Honest	47.05	3.39	3.23	.002
	Deceptive	46.15	1.58		
Drug Use	Honest	46.05	3.32	1.80	.07
	Deceptive	45.57	0.00		
Unauthorized Resource Usage	Honest	43.09	5.65	10.28	< .001
	Deceptive	37.88	3.13		
Dishonesty	Honest	48.06	7.25	9.16	< .001
	Deceptive	42.72	2.96		
Arrival Tardiness	Honest	47.10	6.26	8.53	< .001
	Deceptive	42.30	3.56		
Interpersonal Conflict	Honest	46.20	4.70	3.95	< .001
	Deceptive	44.61	2.36		

Note. $N = 160$.

Table 4. Correlations between HARM subscales and HEXACO personality traits.

		H	E	X	A	C	O
Truthful	Alcohol Use	-.03	.06	-.05	-.10	-.11	.02
	Interpersonal Conflict	-.05	.10	-.07	-.34**	-.07	.01
	Unauthorized Absenteeism	-.11	.05	.01	-.21**	-.06	.12
	Missing Deadlines	-.01	.09	-.10	-.07	-.01	.03
	Drug Use	.09	.06	-.07	.04	-.03	.09
	Unauthorized Resource Usage	-.16*	.11	-.09	-.18*	-.09	.03
	Dishonesty	-.22**	.02	-.05	-.19*	-.08	.06
	Arrival Tardiness	-.07	.05	-.11	-.17*	-.08	.10
Deceptive	Alcohol Use	-.08	.03	-.12	.06	-.13	-.09
	Interpersonal Conflict	-.16*	-.06	.003	-.16*	-.17*	-.11
	Unauthorized Absenteeism	-.08	.08	-.04	-.08	-.09	-.07
	Missing Deadlines	-.03	.03	.01	-.04	.06	.02
	Drugs	[a]	[a]	[a]	[a]	[a]	[a]
	Unauthorized Resource Usage	-.004	.05	-.04	-.02	-.07	-.06
	Dishonesty	-.16*	.04	-.02	-.21**	-.16*	.01
	Arrival Tardiness	.03	.06	-.18*	.01	-.22**	-.23**

Note. $N = 160$.

[a] No correlations were calculated for Drug Use scores in the Deceptive condition because there was no variability.

Emotion, Attention, and Decision Making: Their Interaction, and Potential Impact on Deception

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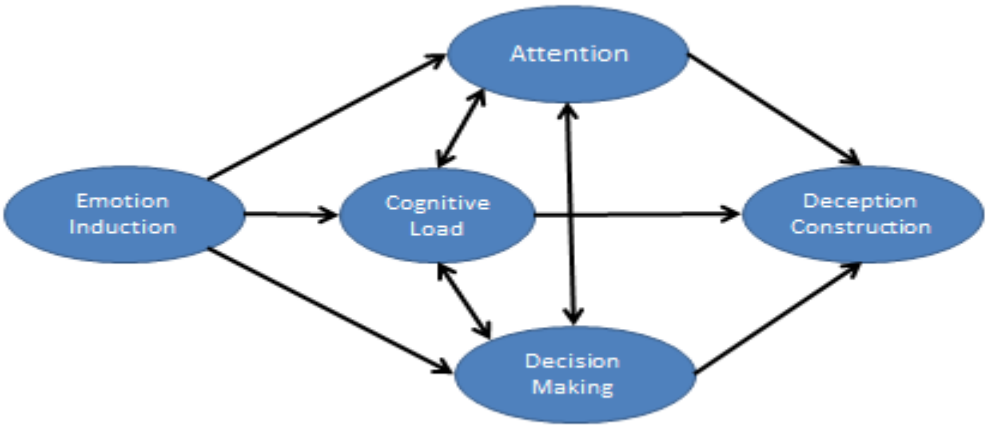
Abstract

The induction of emotional states produces significant effects in other domains of cognitive processing. Emotional experiences affect attentional mechanisms, decision making capability, and can impose considerable strain on mental resources under the rubric of cognitive load. Successfully constructing a deception involves several steps, including the allocation (and focusing) of attention, and other cognitive activity associated with decision making. The goal of the present work is to seek a clearer explanation of how emotion ultimately impacts deceptive behavior. The proposed model traces a path from emotional induction through attention, decision making, and cognitive load, through a discussion of the potential facilitative or detrimental effects (of emotional experiences) on the ability to deceive.

Introduction

Human behavior is suitably envisioned as arising from a dynamic interplay between systems. Accordingly, both neuroscientific and cognitive evidence frequently serve to account for the apparent nature of observable systemic interaction. The present work outlines a multi-stage relationship between emotional processing and the (ultimate) ability to construct a deception, contending that emotion influences one's ability to deceive by impacting several systems prior to the output of lying. I will make the case that emotional processing affects attentional resources (generally), specific phenomena associated with resource-limiting constraints of cognitive load, and aspects of decision making ability, by using a 'levels-of-analysis' approach to detail the putative path from emotion induction to deception construction. Research examining the major theoretical constructs individually (and potential relationships between systems) will demonstrate the putative phasic progression from creating an emotional state to deception production. A graphical depiction of the current model under consideration follows directly below.

The Integrative Model



I. Defining 'Emotion'

Some suggest that rigorous, consensus agreement on terminology is an unnecessary first step for the scientific study of behavior-based constructs (Pessoa, 2013). A chief contention of that argument rests in the idea that exploratory research often guides the revisionary process of defining terms; at least, more frequently than the reverse. Acknowledging the descriptive variability attached to the construct of emotion (Lang, 2010), it appears to remain beneficial to impose at least some conceptual outline for its investigation. Thus, Kolb and Whishaw (2009) provide a sufficient depiction of the idea: a state of mental excitement characterized by alteration of feeling tone, and by physiological and behavioral changes. This 'working' definition of emotion informs the subsequent discussion on both the time-course of emotional experiences, and the neural networks involved in relevant processing.

Appraisal vs. Automaticity

Whether automatic or controlled (appraisal-based) mechanisms guide human emotional processing generates considerable scrutiny among researchers. Classically, William James's stance allowed the possibility that occurrences of emotion could indeed be immediate. The insistence that rapid 'bodily changes' accompanied emotions strongly implied this notion (James, 1892; Deigh, 2014); the instantaneous autonomic reaction associated with fear when unsuspectingly confronted by a bear is perhaps the most repeated example. Recently, accounting for emotional experiences in terms of automatic processing continues to receive support. Using magnetoencephalographic (MEG) measures, Luo et al (2010) demonstrated early (40-140ms) amygdalar responding to the presentation of emotionally-laden stimuli (human faces). They interpreted the results as activation that occurred independently of attentional awareness. Pessoa (2013) also noted that, following the manipulation of visuospatial variables, the perception of emotion (discerned by amygdalar activity) occurs without the benefit of directed attention; the term "obligatory" describes the processing speed of certain emotionally-laden content.

Evidence from the literature on motivation and the nature of goal directed behavior also indicates the potential for automatic processing. Custers and Aarts (2005) found that the induction of emotional states (prominently, the positive type) from a baseline of 'neutral' involved elements of non-conscious processing; again, hinting that the impact of emotion occurs outside the bounds of explicit cognitive activity. Additionally, immediate processing correlates with negative emotional states. In a series of experiments investigating ties between memory and emotion, Kang, Wang, Surina, and Lu (2014) observed better retention for negatively-valenced words (part of the emotion-enhanced memory effect, or EEM) associated with automatic processing.

A competing viewpoint of automaticity materialized in the form of Arnold's (1960) idea that the experience of emotion requires cognitive evaluation (appraisal). More current work echoes the likelihood of a markedly dynamic relationship between appraisal and emotion, in the context of 'core affect' (defined along the dimensions of valence and arousal). Kuppens, Champagne, and Tuerlinckx (2012) had participants provide information on characteristics of core affect and appraisal across a series of real-time events occurring outside of the laboratory; they found an ongoing bidirectional influence. Moors (2013) also noted support for the relationship by concluding that appraisal processes act as catalysts in a cyclical progression with the experience of emotion. Khan, Nelson, and Handler (2009) proposed that appraisal (divisible into conscious and subconscious subtypes) may also serve a function in the context of facilitating goal orientation. Further, heightened awareness through conscious appraisal is thought to provide the advantage of adapting to one's environment, while concurrently affording increased interpretive power to characterize experiences (Handler, Shaw, & Gougler, 2010).

A growing number of researchers contend that the traditional framing of appraisal in mediating cognition and emotion may be an oversimplified explanation. Moors, Ellsworth, Scherer, and Frijda (2013), for example, stated the value of viewing the complexity of human emotional experiences as a function of somatic, motivational, and cognitive factors. Indeed, a general trend in appraisal-based research

highlights an increasingly nuanced functional structure, inclusive of the impact (on emotion) of metacognitive confidence level (Tong, Teo, & Chia, 2014), and the influence of cognitive re-appraisal on emotion regulation (Buhle, et al 2014).

It is possibly more reasonable to describe the variability of human emotion in a mixed model involving both automatic and appraisal-based types of processing. For example, amygdalar activation occurs in response to emotion induction with and without the presence of attentional processing (Luo, et al, 2010). Further, each 'branch' of theories received criticism: automatic processing may be limited to stimulus-specific cases, such as the detection of emotion in faces (Rellecke, Palazova, Sommer, & Schacht, 2011); and, one of the notable (fundamental) flaws with appraisal theories concerned the (artificial) presumption that appraisals and emotions operate independently (McEachrane, 2009). Finally, in a review analyzing the time-course of attention and emotion-based amygdalar processing, Pessoa (2010) reiterated the prospect that successfully decoupling the two domains proves a daunting task. To gain a clearer picture of the nature of emotional processing, it is necessary to take a more detailed look at the neural representation of emotions in the brain.

Areas Linked with Emotional Processing

A complete review of brain areas underlying emotional experiences is beyond the scope of this paper; instead, a brief mention of some of the more notable regions involved follows. A wealth of evidence solidifies the amygdala as a prominent structure for processing emotional information across a wide range of contexts. Armony (2013), for example, stated that both positively and negatively-valenced auditory (voice, music) and visual (face, body) stimuli can trigger amygdalar activation. These findings were partially supported by Vrticka, Lordier, Bediou, and Sander (2014), who elicited activation from dynamic (computer-generated) facial expressions in 3-dimensional space. The amygdalae are also sensitive to 'socio-emotional' cues, even under conditions of ambiguity, portrayed by the interaction of inanimate objects (Phelps, 2006). Further, clinical evidence of double dissociation supports the integral role of the amygdala in emotional processing, as Bernston et al. (2007) observed decreased arousal to negative stimuli in patients with amygdalar damage, relative to a control group with lesions (strictly) elsewhere in the brain.

Emotional processing, however, is not restricted to amygdalar space. Work dating from the beginning of the 20th century on the physiology of emotional experiences began to implicate thalamic (and later, hypothalamic) activity (Dror, 2014); an idea that receives continued support (Hartikainen et al., 2014). Landa et al. (2013) investigated networks related to interpersonal (i.e., based on interactions with "others") vs. non-interpersonal emotions. Interpersonal emotional experiences correlated with activity in anterior and posterior cingulate cortex, the parahippocampus, medial frontal and temporo-parietal areas. Concerning motivation, the presentation of appetitive stimuli (tied conceptually to positive emotions) coincided with activation in the nucleus accumbens, and a ventral portion of medial prefrontal cortex (Lang, 2014). Functional MRI results from studies employing subliminal facial expressions demonstrated activity in temporo-parietal, inferior and dorsolateral frontal regions (Prochnow et al., 2013). Further, increased ventrolateral prefrontal cortical (vPFC) activation results in response to the display of emotional pictures; an effect which appears to strengthen across development (Vink et al., 2014).

Research also suggests insular cortical involvement with emotional processing. Gasquoine (2014) asserted that areas within the insula respond to the interpretation of autonomic information. Gasquoine also noted that clinical studies revealing abnormal volumetric (insular) grey matter levels link the anomaly to addiction, and various mood disorders. Additionally, Denny et al. (2014) found that insular activation increased in response to the repeated presentation of negative pictures, the habituation to which accompanied a strengthened connectivity with the amygdala.

Substantial evidence corroborates that emotional information processing takes place in a widely-distributed manner. A diverse array of dynamic behavioral phenomena points to brain regions that deal with emotional in-

formation. Ziaei, Peira, and Persson (2014), for example, offered evidence of activation in the insula, amygdala, and medial and lateral prefrontal areas when attention is focused on emotionally-laden content. Further, Kohn et al. (2014) demonstrated that an area in the dorsolateral prefrontal cortex may be critical for the initiation of processing tied to emotion regulation.

The Circumplex Model

Selecting an appropriate model to represent the putative structure of human emotion is an important precursor for the operationalization of potential underlying structural components. Thus, for the purpose of this project I've selected a relatively simple, well-established model to blueprint the (cognitive) processing of emotion perception. A two-dimensional 'circumplex' depiction of emotion that describes experiences simultaneously along continua of valence (pleasure-displeasure) and degree of arousal (low-high) is suitable (Russell, 1980). The two dimensions allowed bipolar representations of level of wakefulness vs. sleep (arousal), and for the inclusion of emotional valence examples from sad and frustrated (displeased), to happy and serene (pleased). According to Russell, the circumplex structure consistently emerged despite subjecting behavioral data to a number of different factor analytic, dimensional scaling methods. Accounting for emotional experiences in terms of valence and arousal successfully applies across a wide range of (both clinical and normal) samples (Kring, Barrett, & Gard, 2003).

Critics fault circumplex theorists for attempting to divide emotional experiences along spectrum-based dimensions. Haslam (1995) suggested a more appropriate characterization to include a multitude of discrete categories, and Feldman (1995) cautioned against the way participants subjectively weight the two dimensions during self-reports. The recent development of a more refined iteration of the model addresses the above concerns, allowing a greater degree of specificity in fitting attributes of core affect ("raw, unreflective" feelings). Yik, Russell, and Steiger's (2011) 12-point circumplex model permits the dynamic inclusion of external variables through maximum likelihood estimation methods, while affording an increasingly detailed path for describing emotional components that integrates prior models. Carney and Colvin (2010) provided additional evidence for the applicability of the circumplex model, demonstrating successful accommodation of a wide range of social behaviors (potentially relating more directly to the interactive aspects of deception). Kang, Wang, Surina and Liu (2014) illustrated its facilitative role for the investigating emotion-enhanced memory effects. Further, Pettersson et al. (2013) noted that the structure of the circumplex withstands complex, longer-term (~90 days) dynamic systems testing procedures modeling emotional variability and return to a 'baseline' state.

Alternative Models

Competing theorists have argued that valence and arousal (alone) are insufficient to capture the full extent of the human emotional experience, and have proposed the existence of additional dimensions. Using stimuli from the International Affective Picture System (IAPS), Jerram, Lee, Negreira and Gansler (2014) uncovered brain activation in response to manipulating a dominance aspect of processing, related to the ability to impact one's environment. Weierich and colleagues (2010), also using IAPS stimuli, varied image presentation according to familiarity, citing amygdalar activation as evidence for a separate salience (or, novelty) dimension in emotional processing.

Alternative models of emotional structure are not limited to human peer interaction. For example, Saariluomaand and Jokinen (2014) offered evidence of a bipolar 'competence-frustration' dimension, though it remains unclear if the proposed construct is restricted solely to the context of interfacing with technology. Others sought to replace dimensions in the circumplex model, substituting 'intensity' for the traditional arousal dimension (Talarico, LaBar & Rubin, 2004).

A full evaluation of multidimensional models of emotion beyond the circumplex is outside the reach of this paper. An exploration of models (with different dimensional combinations) described above holds valid interest for a later stage of investigation. Indeed, it is a repeated notion that the ideal parsing of emotional experiences ought to occur along

(at least) three dimensions (Smith and Schneider, 2009). It is also questionable whether qualitative or quantitative measures are more appropriate for an accurate representation of emotional space (Backx, 2012). For the initial iteration of the current project, however, the variables of valence and arousal seem a reasonable starting point for investigating the interference of emotional processing with cognition; and ultimately, how this may impact deceptive ability. It is imperative to gain a solid understanding of the core mechanisms involved in how emotion affects cognition. The comparatively simpler structure of the circumplex model lends itself well to this endeavor, though it remains sensible that increasingly complex models of emotion might offer useful guidance for future work.

Valence, Arousal, and Neural/Biological Correlates

The operationalization of both valence and arousal frequently manifests along number scales with psychometric markers ranging from "not at all" to "extremely". The values indicate positivity/negativity (valence), and the general degree of arousal following the presentation of emotionally-laden stimuli. For valence, the mental operations underlying its delineation include dynamics of approach and avoidance types of behavior, not limited to a hedonistic pleasure-seeking component influencing motivation (Bradley & Lang, 2007). Characterizing arousal remains a more elusive, ambiguous endeavor. Sometimes frustratingly, arousal is subject to (co-occurring) influences stemming from psychological (e.g., perceived level of arousal) and physiological (response to bodily change) factors (Scherer, 2005), such as the multidimensional intertwinement of higher-order cognitive, motivational, and emotional influences (Handler & Honts, 2007). For example, Handler, Royner, and Nelson (2008) identified allostatic (roughly, the tendency to restore homeostatic functioning) physiological regulatory processes as a mechanism driving arousal in an effort to temper emotional reactions to salient stimuli during polygraph testing. Using the circumplex model as a theoretical foundation, briefly mentioning brain areas associated with the processing of its constituent dimensions offers informative clarification for its (more comprehensive) outline.

Work in the context of memory retrieval localized valence-related activation in the left frontal gyrus and thalamus (Altenmuller et al., 2014). Schneider et al. (1995), using positron emission tomographic (PET) methods, discovered activation in the amygdalae in response to negative valence, specifically. Inducing emotional states using words, Posner et al. (2009) found evidence of two separable systems for processing valence and arousal. Changes in valence correlated with activation in the insula, medial temporal cortex, several prefrontal cortical areas, and the amygdala; blood flow in the anterior cingulate and dorsolateral prefrontal cortex fluctuated alongside differential arousal ratings. Gerber and colleagues (2008) reiterated the notion of two distinct systems, finding blood flow changes associated with arousal in the amygdala, and an area in the medial prefrontal cortex; differences in valence correlated with activity in the anterior cingulate, temporo-parietal areas, and the fusiform gyrus. Clinical evidence also indicates the involvement of the amygdalae in processing arousal, as damage to the region inhibited subjects' ability to process arousal, independent of stimulus recognition (Bernston, et al. 2007). In an MRI study using IAPS stimuli, Nielen et al. (2009) observed activation in medial temporal, orbitofrontal, and lateral prefrontal areas in response to changes in valence, and medial temporal, hippocampal, and ventrolateral prefrontal activation tied to arousal.

The above listing of neural networks and physiological changes associated with valence and arousal above is not meant to be exhaustive. However, it adequately represents some of the more 'recurring' areas of activation seen in response to emotional information processing, and serves as a decent locational outline of how (mechanistically) the human emotional experience may disrupt other forms of cognition in later stages of processing.

Emotion Induction

After settling on a model for the parsing of emotion, taking a brief look at the way emotions have been experimentally induced (visualized either as a function of a departure from a "baseline" state, or a switch between disparate categorical emotions) is valuable. A great degree of sensitivity can accompany emotional

experiences, with some claiming that (merely) the act of appraisal itself generates emotion (Moors, 2013), and others citing evidence of the effectiveness of statements to induce emotion (Velten, 1968; Smallwood & O'Connor, 2011). The discussion below focuses on the different types of stimuli typically employed in emotional testing paradigms, with particular interest devoted to the issue of static versus dynamic induction methods.

The investigation of emotional processing often uses pictures, such as the collection of standardized images that make up the IAPS (Lang, Bradley & Cuthbert, 2008). The IAPS sees continued use, as Radua and colleagues (2014) demonstrated that exemplars (of both positive and negative valence) elicit brain activation during fMRI. Winton, Clark and Edelmann (1995) also successfully induced emotions with pictorial depictions of facial expressions. Further, static facial expressions associate with emotional information processing, even when neutral stimuli 'mask' the content (Suslow et al., 2013). The relationship between facial expressions and emotion induction persisted when temporal limitations make conscious processing unlikely (Prochnow et al., 2013). It appears that the usage of pictures to instantiate emotion remains a valid technique, producing results in both behavioral and neuroscientific domains.

Dynamic stimuli also effectively induce emotion. Studying the effects of emotion on motivation, Loizou, Karageorghis and Bishop (2014) manipulated emotional space (in terms of the circumplex model) using music and video clips. In the context of addiction research on self-control, Shmueli and Prochaska (2012) elicited emotion through positive and neutral videos and writing tasks. Similarly, Lazar and Pearlman-Avnion (2014) demonstrated successful mood induction using separate techniques (video and music clips); notably, with a stronger effect connected to the former. Demaree and colleagues (2004) found positive and negative videos (e.g., animal slaughterhouse footage) effective for emotion induction, observing physiological changes as well (variations in heart rate and skin conductance). Forgeard (2011) used positive, negative, and neutral videos to study the nature of emotional states and their impact on creativity. Indeed, the use of dynamic stimuli seems reliable for the induction of emotion, with both real actors (Winton et al., 1995), and computer-generated 3-dimensional faces (Vrticka et al., 2014).

While several methods experimentally induce emotional states, dynamic stimuli appear more suitable for the task; intuitively, they seem (by nature) more 'interactive' than their static (picture) counterparts. The act of 'keeping up with' an unfolding series of events in real time may also recruit additional mental resources, thus subjecting one to a higher likelihood of interference with cognitive processing at later stages.

Relevance to the Integrated Model

The above section focused on establishing a genesis point for the larger model of how emotion may impact deceptive behavior. I presented a theoretical account of emotion, evaluated both in terms of cognitive dimensions and neural processing mechanisms. An aim of the current project is to show that similar networks (and processes) are also involved at subsequent phases of the proposed model; and, that an overlapping systems view may offer partial explanation of how emotional experiences can interact with attention, decision making, and the ability to deceive. The present work also addressed contemporary competing models; revisiting them could be informative in terms of identifying limitations (or potential areas of expansion) in the discussion of emotional interference. Finally, a brief review of the types of stimuli used to induce emotion assisted in materializing the nature of events occurring at the initial stage of the dynamic model.

II. Emotion, Attention, and Decision Making

Applying a fixed quantitative structure to the science of decision making presents difficulty, particularly in arenas where ethical considerations are at play (Bates, 1954). In the context of a model involving an output of deception, approaching an interactive perspective with emotion requires a brief mention of aspects associated with decision making.

Recent work suggests that individuals likely adopt a consistent, singular strategy for problem solving, rather than selecting between multiple methods (Sollner, Broder, Glockner &

Betsch, 2014), though this notion is not without criticism (Elqayam & Evans, 2011). One component of decision making particularly applicable when suppressing the truth is the inhibition of a more powerful (prepotent) competing response. White et al. (2014), for example, found evidence of inhibition linked with brain activity in the right medial frontal and inferior gyri. Interestingly, Elwyn and Miron-Shatz (2010) proposed the inclusion of multiple emotional factors during the evaluation stage of decision making. In line with the current model, successful decision making is perhaps best viewed (in terms of deceptive output) along the dimensions of accuracy and efficiency (Dambacher & Hubner, 2015).

Cognitive Elements of Attention

A broad discussion of attention's intricate thematic constituents is not the intention of this review. Instead, this section illuminates two mental phenomena implicated in attentive processing (and the overall model under investigation): the central executive, and task rules. Originally conceived in the context of research on working memory (Baddeley & Hitch, 1974), the central executive (conceptually) underwent a progressive transformation. An idea of expansion replaced the notion of its exclusivity in terms of a restricted area within the frontal lobes (and 'singular' application to memory). Proponents now believe its reach (both anatomically, and with regard to process involvement) more widespread than initially thought (Baddeley, 1998; Garavan, Ross, Li & Stein, 2000).

A partial list of functions of the central executive includes: inhibiting information not relevant to goal-directed behavior, attention switching, integrating new with existing information, and the management of concurrent tasks (Collette & Van der Linden, 2002). Fournier-Vicente, Larigauderie and Gaonac'h (2008) offered similar justification for parsing the central executive to include the attentional aspects of selection and switching, though they failed to find compelling evidence of a (unique) dual-task management function. Conceivably, several executive processes from the abbreviated list above likely engage (if differentially) during the construction of a deception.

Another important cognitive concept relevant to the current project concerns task rules. Essentially, task rules are strategies (often categorically-based) thought to affect performance during cognitive testing. Some suggested that task-related information must be held in an 'active' representative form (Waskom et al. 2014). However, additional evidence indicated the implementation of task rules sometimes occurs through automatic processing, outside of the need for active maintenance (Yamaguchi & Proctor, 2011). There is also evidence that the manner in which task rules impact performance correlates in part with task complexity (Duncan, Schramm, Thompson & Dumontheil, 2012). Further, it is unclear whether the assignment of task rules facilitates performance or causes decrements, particularly in situations involving attention switching (Dreisbach, 2012). Notably, switching paradigms acquired longstanding use in the investigation of deception, though the presence of reliable effects has been debated (Debey, Liefooghe, De Houwer & Vershcuere, 2014).

Neural Networks of Attention

The study of attention's subcomponents yields several loci of activation throughout the brain. Here, a thorough review is omitted in favor of a closer look at neural networks relevant to the current model. One of the more prominent circuits identified with attentional processing involves areas in the frontal and parietal lobes. The number of potential subdivisions within the fronto-parietal network continually evolves. Some researchers currently claim as many as eight constituents (separable by processing characteristics), such as the allowance for multiple representations that assists in task-switching (Szczepanski et al., 2013). Evidence from resting-state fMRI work reinforces the existence of a fronto-parietal network, citing the presence of an 'intrinsic connectivity network' (ICN), which demonstrated temporally synchronous activity between frontal and parietal areas, even in the absence of task demands (Markett et al., 2014). Further, Sripada et al. (2014) used fMRI to uncover fronto-parietal connectivity alterations in response to the emotional regulation strategy of reappraisal; Okon-Singer et al. (2014) provided supporting evidence of attentive processing (in response to nega-

tive and neutral emotional stimuli) linked with changes in fronto-parietal areas. Hilti et al. (2013) observed bilateral activation in a circuit involving fronto-parietal areas (and locations in cingulate and insular cortex) in response to attentional demands associated with a rapid visual information processing (RVIP) paradigm.

Additional research implicates specific frontal areas in attentional processing. Sridharan, Levitin, and Menon (2008), for example, found evidence of a right hemisphere fronto-insular connection when tasking subjects with switching between central executive and default mode (roughly, resting state) networks. Also, lateral prefrontal areas show activation in conjunction with attentive and evaluative processing, under conditions involving a variation of the oddball paradigm (Han & Marois, 2014). Further, both medial and lateral prefrontal areas appear to be involved when subjects are tasked with directing attention toward emotionally-laden pictorial stimuli (Ziaei, Peira, & Persson, 2014). Interestingly, evidence from clinical fMRI research points toward aberrant activity in the left dorsolateral prefrontal cortex during attention-guided tasks in adult ADHD patients (Hoekzema et al., 2014).

Considerable support exists for the notion of interactivity between neural systems underlying attentional processes. In a paper reviewing the neuroimaging of attention, Vossel, Geng, and Fink (2014) mentioned compelling examples of an interactive relationship between dorsal (frontal eye fields and the intraparietal sulcus) and ventral (temporoparietal junction and ventral areas of frontal cortex) circuits; the two networks presumably work in concert for the integration of top-down and bottom-up attentional processing. Similarly, Posner (2012) offered that while the networks (in this case referenced with functional designations “orienting” and “self-regulatory”) may be anatomically distinct, their interaction could hinge upon task difficulty and/or switching. The ventral attentional network also links with subcortical structures such as the locus coeruleus (Walz et al., 2013), which connects to the amygdala (van Marle, Hermans, Qin, & Fernandez, 2010).

Attentional processing clearly occurs in several different cortical (and subcortical) locations. Fronto-parietal circuits subserving executive functioning (Collette & Van der Linden, 2002) are well-known. Translational research implicated an amygdalar-basal forebrain link in the processing of goal-oriented attention (Peck & Salzman, 2014), and attending to novel stimuli evoked activation of reward circuitry (Gottlieb, Oudeyer, Lopes, & Baranes, 2013). The areas discussed above demonstrate the extensive nature of the distribution of neural networks underpinning attentional processing.

Emotion and Attention

Taking a look at the dynamic relationship between emotion and attention helps build a case for the current model. Emotion and attention are strongly linked. Carretie (2014), in reviewing literature on exogenous attention, notes the efficacy of emotionally-laden stimuli in the elicitation of automatic attentional processing; Shaw et al. (2011) provided further evidence of emotion perception occurring outside of ‘central’ attentional processing in a study using facial expressions. Emotion also influences attentional scope. Huntsinger (2013) speculated that the induction of emotion affects whether individuals adopt a broad (global) or relatively narrower (local) attentional focus; though, the determination may lie more heavily upon one having access to either style. Specifically, the flexible link between emotion and attention seems to depend on the availability of global versus local focus. Interestingly, under certain conditions a positively-valenced emotional state sufficiently induced the use of both global and local focus (separately); negatively-valenced states produced similar results.

Whether the cognitive impact of emotional experiences facilitates or inhibits attentional processing remains unclear. In a recent review, Pourtois, Schettino, and Vuilleumier (2013) discussed evidence suggesting emotional induction increases performance, observable across behavioral measures of reaction time, and accuracy in spatial orientation tasks. Further, Sussman, Heller, Miller, and Mohanty (2013) offered the idea that performance-enhancing effects of emotional induction depend upon subtle changes in valence and arousal, finding improved task-related attention in response to low-arousal negative

stimuli. Emotion induction also coincides with disruptive effects on attentional processing. In a study using IAPS stimuli, Sommer et al. (2008) reported decrements in task performance in a spatial cueing experiment following the induction of negative emotion. Additionally, Vogt and De Houwer (2014) noted the tendency for emotional suppression to impact attentive performance in a perseverative manner (using the emotion of disgust). Successful shifting of attention (from aversive stimuli) occurred in response only to the presentation of positively-valenced stimuli; neutral stimuli appeared ineffective in this regard.

The interactivity between emotion and attention is also discernible in neural terms. Pourtois, Schettino, and Vuillemier (2013) documented both direct and indirect (such as through the basal forebrain) amygdalar projections to frontal, parietal, and various areas of sensory cortex. Concerning the diminished fear response associated with psychopathy, Larson et al. (2013) have also implicated a connection between goal-directed attention and emotion in both amygdalar and lateral prefrontal areas, though additional work illustrates the capacity of more medial prefrontal areas to resist emotional interference (Geday & Gjedde, 2009). Reviewing the temporal nature of emotion-attention interactions, Pessoa (2010) also deemed the amygdala an instrumental site.

Growing evidence indicates the importance of the thalamus in mediating the relationship between attention and emotion. In a review of neuropsychological literature, Arend, Henik, and Okon-Singer (2014) noted specific subdivisions of the thalamus (particularly pulvinar areas) show involvement with binding emotional content in working memory processes. Further, Hartikainen et al. (2014) found the therapeutic technique of deep brain stimulation, when applied to thalamic areas, affected both response inhibition and attention allocation to threatening stimuli (rearranged elemental figures in a go-no go task). Thalamic-cortical connections are also implicated with complex appraisal functions during evaluative emotional processing (Handler, Deitchman, Kuczek, Hoffman, & Nelson, 2013). The brief review above establishes numerous cognitive domains and neural locations as fitting candidates for the interplay between attention and emotional processing.

Emotion and Decision Making

In order to assist with theoretically validating the model under investigation, we must examine the relationship between decision making and emotional processing. Threat detection is considered a simplistic form of decision making. Accordingly, LoBue (2014) found evidence that negatively-valenced emotion induction facilitated the rapidity of detecting threatening stimuli. In contrast, studies involving clinical populations indicate the disruptive effects of negative emotional states on decision making in those with anxiety and depression (Paulus et al., 2012). Positive valence also demonstrably impacted decision making, though it may be less effective than its negative counterpart (Mohanty & Suar, 2014). Investigators debate whether positive and negative emotions exert consistent, directional effects on decision making, however, with some favoring an approach that evaluates the influence of valence at the level of unique emotions (Lerner & Keltner, 2000; Jeon, Walker, & Yim, 2014).

That changes in arousal can produce differential effects on performance is a long-held idea (Yerkes & Dodson, 1908). More recently, in a review of factors that influence decision making, Roets and Van Hiel (2011) ensconce arousal firmly in an integrated model of precursors to judgment and decision processing, placing the emotional dimension early in the chain of processing. Further, Suri, Sheppes, and Gross (2013) identified the component of arousal in a model developed to predict decision making outcomes. Moriya, Takeichi, and Nittono (2013) assert that variations in arousal emerge during lexical decision tasks, and may facilitate semantic representation. It seems realistic to acknowledge that fluctuations in arousal levels likely impact many cognitive processes (including decision making). It remains unsettled the extent to which individual differences in factors such as personality may influence the effects of arousal manipulation on later processing (Dresler, Meriau, Heekeren, & van der Meer, 2009).

Supporting evidence exists that the interaction between emotional processing and decision making may also take place indirectly,

involving additional constructs beyond valence and arousal (Phelps, Lempert, & Sokol-Hessner, 2014). In a series of experiments looking at 'intuitive' decision making (in the form of an updated version of the Iowa gambling task), Dunn et al. (2010) found that altering the level of interoception (perception of bodily change) affected both decision making and the perception of emotion. Fallon et al. (2014) observed increased information searching ability in subjects with higher emotional intelligence. Further, the act of reappraisal influenced the acceptance of hypothetical 'offers' in economically-based decision scenarios (Grecucci et al., 2013). Taken together, the work above illustrates the widespread potential for a dynamic relationship between emotional processing and decision making.

Emotion and Cognitive Load

Emotional processing also exerts putative effects on cognitive load. Miller (1956) long ago put forth the notion of limited resources to devote to mental operations involving information processing. Further, when taxed by tasks which divide attention, the allocation of those resources can widen or narrow one's field of view (Williams, 1982). Cognitive load, then, is imaginable as the relative amount of strain on processing resources at a given point in time. Sweller (1988) framed the matter in terms of learning, where the acquisition of more 'expert' based schemas allows for greater efficiency in cognitive processing; others favored a more 'direct' approach believed to better disentangle individual mechanisms (van Gog et al., 2009).

Choi, van Merrienboer, and Paas (2014) recently emphasized the importance of emotional characteristics of the learning environment in attempting to name contributing influences on cognitive load. Consistent with the concept of limited resources, Berggren, Richards, Taylor, and Derakshan (2013) observed a decreased impact of emotion induction (using facial expression stimuli) on attentional processing under conditions of elevated cognitive load. Pessoa (2010) hypothesized emotion-attentional networks' involvement with certain selective processes, assisting in the selection of attention to environmental stimuli. Despite pronounced variability in the available processing capacity unique to an individual's cognitive load (Fitousi & Wenger, 2011), the study of the nature of mental resource allocation remains promising (Lavie, 2010). Cognitive load also likely serves a mechanistic interaction between emotion and attention. Emotional experiences demonstrate influences on attentional processing (Li et al., 2014), and it is possible this phenomenon reflects a 'preference' (in terms of resource allotment) given to the processing of salient information. Simply, when heavily-emotional information taxes one's cognitive capacity, a reduced ability to perform additional mental operations may result.

Arousal and Attractiveness

The ability to successfully construct a deception is instrumental to the current model. In the present paradigm, deceptive responses refer to the perceived attractiveness ratings of others. The arousal dimension of the circumplex model may influence such judgments. Dutton and Aron's (1974) landmark study addressed the question with participants walking across either of two levels of a suspension bridge. They found subsequent attractiveness ratings of an 'interviewer' (confederate) were inflated when participants traversed the higher level (indicative of relatively greater arousal). Dienstbier (1979) observed a similar phenomenon when manipulating arousal through a startle-response. In the series of studies, when sudden loud noises accompanied rapid vestibular deflections (induced by tilting chairs), attractiveness ratings of the experimenters increased. The nature of the link between physiological arousal and attractiveness is still under investigation, with more recent work focused on attributes such as arousal source ambiguity (Foster, Witcher, Campbell, & Green, 1998) and power over others (Jouffre, 2015).

Relevance to the Integrated Model

The preceding section represented the next (multifaceted) stage of processing in the larger model, accomplished by following the path from emotion induction to the potential 'next stage' targets: attention (generally), decision making, and cognitive load. Cognitive-theoretical and neural network depictions of attentive processing elucidated numerous avenues for emotion-attention interaction, including the idea that emotional processing

may be a significant determinant in the allocation of attentional resources (framed as cognitive load). I presented research highlighting the differential effects of fluctuations in the circumplex model on decision making ability, offering a more broad review of relevant work with circumplex dimensions, and (through the specificity of the current paradigm) by linking changes in arousal with ratings of attractiveness. Taken together, the relationships discussed above provide compelling evidence of emotional induction's involvement with attentive and decision making processes. Moreover, the structure of the current model carries the likelihood that the interplay detailed influences the output of deceptive behavior.

III. Emotion, Cognitive Load, and Deception

The previous sections identified links between emotional processing, general aspects of attention, cognitive load, and decision making (Schulz, Fishbacher, Thoni, & Utikal, 2014). Deceptive behavior serves as an endpoint in the current putative model. The focus below relies on the acquisition of a greater awareness of more precise mechanisms at play during the final phase of information processing in the model. The concept of cognitive load (and the concomitant notion of resource-restricted processing capacity) then becomes a running backdrop for considering the following associated phenomena: emotion regulation, inhibition, emotional perseveration, and task switching. Each 'operation' presumably acts an impediment to deception construction.

Emotional Regulation

If any mental operation potentially affects the strain on cognitive load, then it is worthwhile to imagine acts of processing associated with the maintenance (or reversal) of one's emotional state in such a manner. Thought suppression is one of the more frequently employed strategies in the regulation of emotion. While seemingly adaptive (in terms of shielding against negatively-valenced experiences), the act of suppression often carries a cost (Geiger, Peters, & Baer, 2014). In a series of experiments, Baird et al. (2013) directed subjects to suppress intrusive thoughts about previous romantic relationships. They found suppressed thoughts linked with a "decoupling" of attention from task performance, and that emotional content affected cognitive load outside of conscious awareness. Apart from one's romantic history, Nixon, Nehmy, and Seymour (2007) noted more immediate effects of cognitive load linked with the presence of intrusive thoughts. Further, Najmi and Wegner (2009) observed thought suppression associated with a 'rebound' of the intended target(s) to be suppressed, and highly taxing on cognitive load; the researchers also questioned its overall effectiveness for emotional control. Thought suppression clearly involves cognitive resources. Applying an emotional component to that dynamic may add another impediment to the increasingly difficult task of deceptive behavior.

Inhibition

In order to lie successfully, one must often suppress the (reactive) truthful response (Verschuere, Spruyt, Meijer, & Otgaar, 2011; Hadar, Makris, & Yarrow, 2012); such an act likely incurs a measureable cognitive penalty. Simply, the inhibition of a truthful response (as a precursor to deceptive behavior) should manifest in longer reaction times when lying (compared to truth-telling). In support of this idea Farrow et al. (2010) reported a temporal disadvantage to lying in terms of processing speed, and suggested that individual variability in verbal memory may enhance the difference. The discrepancy between lying and truth-telling (through the behavioral lens of reaction time) appears generally reliable, but the temporal gap contracts under certain circumstances. Hu, Chen, and Fu (2012), for example, implemented a paradigm involving lying about self-referential information. They found that subjects who received instruction to reduce speed displayed significantly lower reaction times when lying, and that the processing difference between lying and truth-telling essentially disappeared under a condition of more intensive training. Additionally, in a study manipulating the ratio of lying to truth-telling across conditions, Van Bockstaele et al. (2012) observed a decrease in reaction time to deception construction in response to specific training. It appears that, while malleable, a cognitive cost of lying does indeed exist; though, practice effects ought to be taken into consideration when developing experimental paradigms.

Emotional Perseveration

The perseveration of emotional states potentially obscures one's ability to manufacture a deceptive response. Using IAPS stimuli, Smith, Bradley, and Lang (2005) showed behavioral indicators (such as startle potentiation and frowning) persistently evident for prolonged periods of time (~30s) following exposure to negatively-valenced items; though, some supporting evidence hinted that the measurement scale may affect the perception of emotional duration (Verduyn, Tuerlinckx, & Van Gorp, 2013). Attentional processing possibly influences the duration of an emotional experience. Freund and Keil (2012) noted that a redirection of attention from emotionally-laden content sufficiently and effectively 'compressed' the length of subjects' emotional experiences. Verduyn and colleagues (2009) contended that emotional duration rests upon characteristics of strength of emotion at onset, and stimulus salience. Further, Waugh, Lemus, and Gotlib (2001) speculated that both 'active' and 'passive' processes influence the perseveration of emotion, in accordance with explicit awareness. Emotional perseveration also associates heavily with errors in decision making (Hauser, 1999); a dynamic which could interfere with accuracy during tasks requiring both lying and truth-telling. Clinical evidence implies that a dimension of perseveration in anxiety could impact susceptibility to negative emotional states (Rudaizky & MacLeod, 2014). Given the length of emotional experiences coupled with the multipronged accompanying set of putative influential factors, prolonged states of emotion could easily disrupt the construction of a deception.

Task Switching

Many paradigms testing deceptive ability obligate subjects to switch between truth-telling and lying across trials. Diverting resources from one mental task to another in such a situation feasibly contributes to cognitive load. That act of 'rerouting' produces an experimentally-verified processing cost, as Schmitz and Voss (2014) noted increased reaction times under conditions of switching on a letter-number task. Research also suggests that the cognitive cost of task switching stems from the inhibition of (previously activated) processing pathways (Scheil & Kleinsorge, 2014). The impact of emotional involvement on task switching is less well-understood. Yang and Yang (2014), for example, observed decreased reaction times in a card-sort task in a condition of positively-valenced emotion, relative to a neutral state. However, in a sentence-rating task manipulating focus (internal vs external), Oosterwijk et al. (2012) detected similar processing costs across emotional and non-emotional states. In the context of deception, switching between lying and truth-telling also affects processing speed. Debey, Liefooghe, De Houwer, and Verschuere (2014) reported bidirectional (lie-to-truth, truth-to-lie) decrements in reaction time when participants were tasked with switching. Further, Christ et al. (2009) demonstrated activation in frontal, insular, and left posterior parietal areas linked with task switching in a deception paradigm; notably, regions associated with task switching significantly overlapped with areas involved in other executive processes (such as working memory and inhibitory control).

Relevance to the Integrated Model

Research highlighted in the section above represents an effort to account for some of the more pronounced cognitive influences on the ability to deceive. Specifically, the review offered a parsed description of contributing factors at the later stages of processing (believed to more immediately precede the output of deception). Thought suppression as a function of emotional regulation likely taxes cognitive resources that could slow reaction time in a deception-based paradigm. More specifically, the necessary inhibition of truthful information (tied to a given deception) seems to effectively inflate costs associated with processing speed. The perseveration of emotional states warrants additional consideration, as the experimental design of the current model builds (at least in part) on an assumption of one's ability to repeatedly (and relatively expediently) transition between disparate emotional states. Finally, I addressed the idea that task switching influences cognitive load; whether emotional processing facilitates or inhibits remains less clear at this stage. Reference to additional work outlined potential costs in the context of switching between lying and truth-telling.

IV. The Overall Path from Emotion Induction to Deception

This paper moves toward an answer to a (seemingly) basic question: does emotion influence the outcome of deceptive behavior? In light of the work detailed above, this appears a gross oversimplification of the matter under investigation. An initial approach to the question, then, required considerable exploration of the current model's starting point: emotion. I discussed the issue of automatic versus controlled processing, reaching a suitable operationalization for emotional content in the form of the circumplex model. Widespread neural networks underlying emotional processing were presented (Ziaei, Peira, & Persson, 2014), accompanied by a brief review of some of the more common types of stimuli (pictures, video, music clips) used to induce emotional states.

A review of the putative influence of emotion on processing in attention (generally), cognitive load (specifically), and decision making marked the next phase of the model. Cognitive and neuroscientific evidence established a firm relationship between emotion and attention. Indeed, speculation abounds that emotional and attentional processing frequently use similar networks, and that the two phenomena separate less-well than previously conceived (Pessoa, 2013). Additionally, I examined the impact of emotion on a system with limited processing capacity. Emotional characteristics affect many areas of executive functioning (Harle, Shenoy, & Paulus, 2013), and may also exert pressure indirectly through interaction with attentional mechanisms (Li et al., 2014). Decision making appears susceptible to manipulations of the dimensions of valence and arousal; though a more appropriate consideration of influence at the level of specific emotions remains plausible (Lerner & Keltner, 2000).

The final stage represented in the current model covered two separate (but linked) sets of relationships. First, I detailed a group of specific cognitive operations in an attempt to illuminate some of the more immediate ways in which deception construction alters due to processing demands. Deceptive ability may be disrupted (or in some cases, potentially enhanced) by processing involved with the duration (and regulation) of emotions, inhibiting truthful information prior to deception, and task switching in paradigms requiring lying and truth-telling. Second, the suspected dynamics between the precursors outlined in preceding sections bears mention. In a recent review, Gaspar and Schweitzer (2013) asserted that complex decision making situations demonstrate vulnerability to the impact of emotional processing, and that observable changes in emotion both before and after the act of deception emerge. Further, Walczyk et al. (2014) reiterated the notion that emotional states can strain cognitive load when one attempts to deceive. Dunbar et al. (2014) also postulated that successful deception necessitates the management of attentional resources in monitoring thoughts and actions of (both) the deceiver and the target of deceiver. Decrements in the ability to deceive (presumed as consequence of cognitive resource strain) also accompanied a reduction in speech rate (Gamer & Ambach, 2014), perhaps best envisioned analogous to a reaction time measure.

The primary goal of this paper was to trace a path from emotion induction to deception construction; operating from a 'levels of analysis' perspective facilitated the accomplishment of this task. I addressed key elements both individually, and in the context of the nature of their interactions on a more global scale within the overall model. An obvious limitation of the current discourse manifests when examining the directionality of relationships between constructs discussed above. Frankly, the outline followed the progression from emotion induction to the act of deception in a solely unidirectional manner. Putatively, the relationships between cognitive load, attention, and decision making (as precursors of deception) exhibit more recursive tendencies. However, a full examination of the nuances of those relationships outstretched scope of this paper. Instead, I focused on the establishment of a foundational framework to represent a 'stream' of influence from emotion to deception, reserving a more detailed exploration of potential bidirectional relationships among contributing factors for future iterations.

Future Directions

Much of the literature on deception directs inquiry to changes (behavioral and physiological) elicited during the act of lying. How-

ever, deceiving covers only part of the equation; an intended target must also play a role. Considerably less research looks at factors which may influence one's susceptibility to deceptive communication. Harrison, Hwalek, Raney and Fritz (1978), studying cues to deception revealed through interviews, found increased hesitation and (generally) longer responses associated with low believability. These findings reconcile with the work discussed above in the context of cognitive cost. Interestingly, Levine et al. (2011) noted that manipulating a communicator's demeanor (honest vs. dishonest) significantly impaired the ability to detect deception. Further, the confidence portrayed by witnesses (during testimony) appears directly related to subsequent judgments of believability (Tetterton & Warren, 2005). Also, research suggests that self-awareness may increase one's ability to deceive through an enhancement of being able to gauge the mental states of others (Johnson et al., 2005).

Investigating qualities in 'target' individuals that could promote vulnerability, in conjunction with examining the characteristics affecting the veracity of someone committing an act of deception, offers potential utility. James, Boyle, and Bennett (2014) observed an increased susceptibility to financial scams as a function of age, and indirect relationships between susceptibility and a set of socioeconomic factors (income, social support, etc.). Emotional induction may facilitate the detection of deception, as LaTour and LaTour (2009) found participants in positive moods generally less susceptible to false advertising scenarios. Incorporating similar methodology into the framework underlying the current model could prove interesting.

The present global landscape represents fertile ground for studying the impact of deceptive behavior. If emotional induction reliably produces demonstrable effects on the susceptibility to deceptive communication, then far-reaching implications emerge. In political speeches, for example, audience members may eventually acquire skills to avoid distraction through emotional appeals and instead maintain a focus on message content. Concerning national security, interrogators could gain additional awareness of how their own emotional state(s) impact the effectiveness of their questioning techniques. In family situations, cues to risky adolescent behavior might be more detectable if parents learn the nature of emotional involvement in deception susceptibility. Plainly, the identification of a relationship between emotion, deceptive ability, and vulnerability to deception potentially serves to inform virtually any context involving social interaction.

Conclusion

That emotion impacts many forms of cognitive processing does not seem disputable. It remains less obvious whether the influence of inducing disparate emotional states contributes to cognition (consistently) in an enhancing or detrimental fashion. Attentional resources and decision making efforts routinely underlie acts of deception. Further, the group of elements outlined in the model above carries a substantial degree of complexity. Accordingly, such an avowal places deceptive behavior under the impact of a multi-tiered system of (potentially) competing factors. Additional research should focus on investigating the dynamics between emotion, attention, decision making, and cognitive load. A more refined look at the nature of interaction between constituents in the current model offers the chance for a greater understanding of precisely how an act of deception manifests.

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Editorial Review: *Miscarriages of Justice- Actual Innocence, Forensic Evidence, and the Law*

by Mark Handler

Authors: Brent E. Turvey and Craig M. Cooley with contributions from C. Michael Bowers, Stan Crowder, Michael McGrath and Ronald Miller.

The great warrior Sun Tzu, wrote in *The Art of War* "If you know the enemy and know yourself, you need not fear the result of a hundred battles. If you know yourself but not the enemy, for every victory gained you will also suffer a defeat. If you know neither the enemy nor yourself, you will succumb in every battle." Knowing our own limitations and weaknesses can open our minds. Learning vicariously through others' mistakes is a hallmark of the wise.

I reviewed an electronic copy of this text, courtesy of Elsevier. The contents of this book are important and germane to all polygraph examiners, whether working in the government, private and law enforcement sectors. This book is an excellent primer for those who may not read much on the subjects covered. While the writing is at times zealous, it is important to remember the authors are deeply involved with wrongful convictions. They have personally seen the ramifications of the miscarriages discussed. The book shows how a minority of others went wrong, and offers lessons-learned so that the members of our community can avoid the same pitfalls. The authors describe how these miscarriages affected the lives of the wrongly convicted, the true crime victims, the police, the prosecutors, the defense attorneys, the forensic scientists, the reputations of the agencies and of the criminal justice system as a whole. Though it may be more comfortable to allow our own personal dissonance to cause us to ignore these errors, it is not the "right thing to do". Braving through these blunders with an open mind can help make you (and those with whom you interact) better professionals.

What I found interesting in the book is the post-mortem considerations of how these errors manifested. I also appreciated the well-researched descriptions of examples of the errors and how it made me reflect introspectively on human nature. While it is easy to sit back and cast blame and aspersion after reading the examples, having worked in law enforcement I can see how these things came to be. Law enforcement and the polygraph professionals tend to share a strong desire to help society by protecting the innocent. Based on the examples of errors described in this book, these desires (sprinkled with a little ego-involvement) led some misguided people to develop biases and bad habits that had tragic results. So with that context allow me to describe the chapters and content. Again, I remind you these errors were committed by a minority. We know the majority of the profession goes to work each day with good intentions and does not engage in these type of activities.

Section 1 contains two chapters that focus on the nature and frequency of miscarriages of justice. It sets some basic ground rules in terms of operational definitions. It then discusses some research on the wrongful convictions including historical and current studies. Among wrongful conviction experts it is an acknowledged that we will never know exactly how many innocent people are jailed. But that is no reason to not try to put thoughtful consideration into estimates. The United States Bureau of Justice (2005) estimated between 90-95% of all state and federal criminal cases are resolved through plea bargains. There is no paucity of cases where innocent suspects pleaded guilty to avoid potentially harsher sentences, including the death penalty. While many of the Innocence Project cases were resolved because of DNA, it would be tantamount to burying one's head in the sand to think that cases without DNA available are any less susceptible to the errors we read about in this book.

Section two is a four-chapter collection that focuses on investigative errors. Chapter 3 deals with police corruption, and while not pleasant to think about, does exist. The police corruption chapter tries to focus on understanding the underlying causes for police corruption and makes suggestions for trying to improve conditions to reduce the causes. Chapter 4 is an excellent consolidation on the problems with eye-witness testimony, one of the known leading causes of wrongful convictions. Chapter 5 is a short primer on false confessions resulting from poor police interrogation strategies. The scientific literature is clear that much of the interrogation training material promulgated today in the United States is confession-focused and presents a high risk for causing false admissions. False admissions become false confessions that are presented at trial and result in wrongful convictions. More courts are recognizing these false confession generating strategies, thanks to the false confession experts who have been educating those in the legal system. Many confessions are being suppressed because of the well-known psychological coercion caused by confession-focused tactics that continue to be taught today. It is important to remember that if an actually guilty subject's confession is found to be coerced, it is still in peril of being suppressed - as well it should be. Our constitution and laws require statements against self-interest to be knowingly, intelligently, and voluntarily given. Fortunately, there are less risky ways to interview criminal suspects and those interested should research the concept of "investigative interviewing". Chapter 6 discusses problems related to criminal informants, another known leading cause of false convictions. The authors recognize the importance of informants to successful policing but provided examples of how damaging their involvement can become. They provide some excellent examples of how and why informant-police interactions went wrong. Any police officer could benefit from considering these mistakes and incorporating them into their practice habits. Police supervisors could also benefit from learning how others misused their informant relationship and the resulting problems.

Section 3 discusses issues and problems found in the forensic sciences. The three chapters in this section underscore how blind trust in forensic scientists, technicians and their reports resulted in wrongful convictions and even death penalties. I learned a great deal about the paucity of scientific support for many of the CSI-touted scientific tools.

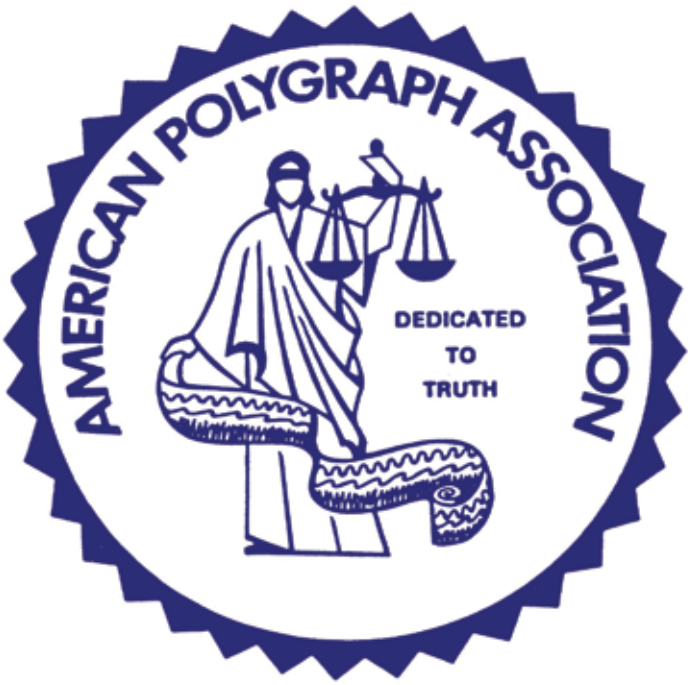
Section 4 has two chapters that discuss some putative legal causes to miscarriages of justice. Chapter 10 provides some outright scary examples of ineffective defense counseling. Some of the examples boggle the reader's mind, in that how could a legal system like ours allow it to happen? Further reading provided some causes for these errors, much of which revolved around the financial wherewithal of the defendant. Indigent defendants are at a severe disadvantage in criminal proceedings. They can't afford the investigative resources that may be needed to help exculpate themselves. They are often assigned a defense attorney who is making very little money representing them. These attorneys have to take on high volumes of clients with small profit. The result can be an overworked, under-attentive defense attorney who recommends plea bargaining.

Chapter 11 describes some of the most egregious behavior in the entire book - prosecutorial misconduct. Prosecutors are arguably the most powerful and most important players in the United States legal system. They decide who to charge, when to charge, what to charge, what evidence to disclose, when to disclose the evidence, who testifies, what plea bargains to offer, and much more. With great power comes great responsibility - normally. But since prosecutors are immune from penalties for initiating and charging the state's case, they may not give their actions sufficient risk-benefit analysis. Prosecutors are generally shielded from any civil liability for bad behavior, even when said behavior results in wrongful convictions. Not being held accountable can (and has) resulted in some of them throwing caution to the wind in order to secure convictions. Fortunately, there have been a few cases where these bad actors' actions were so egregious (and patently obvious) that they were caught and disbarred. For those police officers who strategize with prosecutors about upcoming trials, some of these examples may tug at your conscience.

Section 5 provides two chapters on

remedies and reforms. Chapter 12 offers thoughtful suggestions on forensic reforms and safeguards. It reiterates the problems with blind reliance on expert testimony, without fact-checking. It highlights the importance of separating the role of forensic expert from that of the police or prosecutor. Scientific evidence should be devoid of emotion and human bias. Finally, chapter 13 discusses prevention and management of miscarriages of justice. What steps can be taken to try to prevent them? What steps can be taken to identify when they happen? Once a potential error has been identified, what changes are needed in the legal system to right the wrong? A number of agencies, municipalities and states have created their programs to tackle these concerns. The Innocence Project is a wonderful resource for those seeking more information on reforms.

There are probably numerous examples in history where people felt it is morally correct to err on the side of caution. As far back as the 15th century BC, in the book of Genesis (18:32), God said he would spare Sodom if Abraham could find as few as ten righteous people in the city. The maxim 'Better that ten guilty persons escape than that one innocent suffer' is attributed to William Blackstone, *Commentaries on the Laws of England* in the 1760's. In 1895 in the case of Coffin vs. US, Justice White wrote that "it was better to let the crime of a guilty person go unpunished than to condemn the innocent." These are just a few of the examples I found on this point. Ultimately, this book tends to force a reader to introspectively evaluate whether they feel similarly. If you are not interested in, or bothered, by miscarriages of justice skip this one. If you don't feel you can learn by other's mistakes, you should probably not bother buying and reading this book. On the other hand, if as you read stories about how and why things went wrong, they move you to anger and motivate you to make sure it does not happen on your watch - then this book is for you.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