

The Impact of Technology on the Criminal Justice System

A Psychological Overview



Edited by Emily Pica, David Ross
and Joanna Pozzulo

The Impact of Technology on the Criminal Justice System

This comprehensive volume explores the impact of emerging technologies designed to fight crime and terrorism.

It first reviews the latest advances in detecting deception, interrogation, and crime scene investigation, before then transitioning to the role of technology in collecting and evaluating evidence from lay witnesses, police body cameras, and super-recognizers. Finally, it explores the role of technology in the courtroom, with a particular focus on social media, citizen crime sleuths, virtual court, and child witnesses. It shines light on emerging issues, such as whether new norms have been created in the emergence of new technologies and how human behavior has shifted in response. Based on a global range of contributions, this volume provides an overview of the technological explosion in the field of law enforcement and discusses its successes and failures in fighting crime.

It is valuable reading for advanced students in forensic or legal psychology, and for practitioners, researchers, and scholars in law, criminal justice, and criminology.

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Preface

Emily Pica, David Ross, and Joanna Pozzulo

Various technologies have emerged in the last thirty years to fight crime and terrorism. This book documents these developments and assesses their impact on the criminal justice system. Three historical events were the impetus for this volume.

First, on September 11, 2001, four hijacked commercial planes were used by al-Qaeda terrorists to attack the United States. A total of 2,977 people, including 383 firefighters, died in New York City from the collapse of the World Trade Center buildings. In Washington, DC, 184 people died in the attack on the Pentagon, and 40 passengers died gallantly trying to fight their hijackers, only to have their plane crash in a rural area in Pennsylvania. It was the deadliest day in the history of the United States.

Immediately following the attack, President George Bush created Operation Enduring Freedom, formed the Department of Homeland Security, and launched an international effort to prevent future terrorist attacks. These efforts resulted in technological advances in “global surveillance” designed to identify terrorists. Many of these are examined in [Part I](#) of this volume, “Advances in Detecting Deception, Interrogation, and Crime Scene Investigation.” This section discusses, for example, advances in automated deception detection systems, facial identification and surveillance systems designed to spot terrorists at airports and in mass gatherings, the development of “real-time” law enforcement criminal investigation centers intended to monitor and investigate crime, software that aids police in identifying suspects, and the use of neuroimaging to evaluate the mental status of a suspect.

Second, DNA exoneration studies by the United States Department of Justice found that eyewitness identification errors are the most significant reason for wrongful convictions. As a result, the Department of Justice distributed guidelines to every law enforcement agency in the United States on collecting identification evidence and has updated them since their conception. [Part II](#) of this volume, “Collecting and Evaluating Evidence from Lay Witnesses, Police Body Cameras, and Super-recognizers,” examines

technology designed to increase eyewitness accuracy, including computer programs that collect lineup identification data, generate composite photographs to identify suspects, and physiological measures used to determine whether a witness has crime-relevant information. Additional topics in this section include collecting identification evidence using police-worn body cameras, biometric surveillance systems, facial recognition systems, neurotechnology, virtual reality, artificial intelligence, composite face development software, and super-recognizers—law enforcement individuals who are exceptionally accurate at facial identification.

Third, there has been a worldwide adoption of social media, the Internet, and cell phones. To date, 5.2 billion people have access to the Internet, and 4.8 billion people use social media. Social media is a public source of information about crimes, and witnesses with cell phones can record a public event they observe that has legal importance. For example, few could ever forget a bystander recording George Floyd's cries, "I can't breathe." Bystander videos of the event were instrumental, leading to inner-city rioting and pressure on the legal system to prosecute the officers.

Social media has become a tool law enforcement and the public use to help solve crimes. Police have used social media to collect evidence, encourage community policing when seeking the identity of a suspect, communicate about neighborhood crime, generate investigative leads, or ask for help locating missing people. Sometimes, the public has taken things into their own hands and used social media to investigate crimes, sometimes with mixed results. When the Boston Marathon Bombing occurred in 2013, Reddit users investigated the case. This group called themselves the Reddit Bureau of Investigation (RBI), and unfortunately, they wrongly identified several innocent suspects.

A different outcome occurred when the parents of Gabby Petito turned to the public for help finding their missing 22-year-old daughter, who was last seen with her boyfriend Brian Laundrie in the Grand Teton National Park in Wyoming. A group of citizens on social media investigated the case. It revealed clues that helped police focus their search for Gabby, saving them from having to search over 485 miles of wilderness area. A couple who traveled through the Teton area found Gabby Petito's white van on a YouTube video they posted, a tip that led investigators to the site where Gabby's body was found.

Part III of this volume, "Technology in the Courtroom: Social Media, Citizen Crime Sleuths, Virtual Court, and Child Witnesses," examines the pros and cons of citizens using social media and the Internet to investigate crimes, how recognition software can overcome the adverse effects of social media on eyewitness testimony, how technology in the courtroom is used to communicate with jurors in criminal cases, how the role of virtual courts in criminal cases, and how technology is used with child witnesses.

This volume overviews emerging technologies designed to fight crime and terrorism. Moreover, the authors are from around the world and provide an international perspective on this crucial topic. With the rapid advancement of technology in this field, we hope this volume will encourage others to monitor the evolution of global surveillance technology.

Part I

**Advances in Detecting
Deception, Interrogation,
and Crime Scene
Investigation**



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1 Do Automated and Virtual Interrogation and Deception Detection Systems Work?

*Kirk Luther, Valerie Arenzon, Ashley Curtis,
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and Jessica Lundy*

Do Automated and Virtual Interrogation and Deception Detection Systems Work?

Obtaining high-quality information from witnesses, victims, suspects, and sources (i.e., interviewees) is integral to the successful resolution of crimes (Vrij et al., 2017). The field of investigative interviewing has seen significant advances in interrogation and deception detection practices, including the rise of advanced virtual environments and new automated technologies (e.g., artificial intelligence). To determine whether advances in automated interrogation and deception detection systems are ready for applied use, it is important to understand the roots of these systems—that is, the theories these systems are based on, and how these systems evolved over time to meet the needs of society and incorporate the latest scientific evidence. In the current chapter, we will provide information on: (i) the evolution of interrogation techniques ranging from early (and problematic) practices from the nineteenth century to today’s virtual and automated systems; and (ii) the evolution of deception detection research and practice ranging from over 2,000 years ago to today’s automated and artificial intelligence systems—knowing where we came from will help us better understand where we are now, and where we are headed.

The Evolution of Interrogation Techniques

Third Degree Practices

Early methods of interrogation in the nineteenth century largely consisted of “third degree” practices involving various forms of physical abuse, torture, isolation, and deprivation of basic human necessities such as food and water (Leo & Ofshe, 2008). Society was “at war” with crime and this “get tough” approach to interrogations was believed to be an effective way to elicit confessions—one of the most substantive forms of evidence

for prosecuting individuals (Snook et al., 2014). The judiciary was slow to take issue with third degree interrogation tactics given the apparent success of such methods for obtaining confessions and perceiving such methods as a necessary evil to remove criminals from society (Leo & Ofshe, 2008). However, in 1929, United States President Herbert Hoover ratified a commission to undertake the first national study of crime, the criminal justice system, and law enforcement practices across the country. President Hoover's initiative, which would become known as the "National Commission on Law Observance and Enforcement" produced a series of 14 reports that highlighted deep-rooted problems with the criminal justice system. One such report released in 1931, titled "Lawlessness in Law Enforcement," is cited throughout the interrogation literature as the undoing of third-degree interviewing tactics across the United States (Waite, 1931). It was in this review that law enforcement agencies were first introduced to the prospect of false confessions and misinformation resulting from physically coercive interrogation methods. The report led to widespread public distrust in the criminal justice system and impeded efforts to "professionalize" policing (Leipold, 2020).

Accusatorial Interviews

By the mid-1960s, physical interrogation methods were all but antiquated; techniques centered on psychological persuasion became common practice (Leo & Ofshe, 2008). Polygraphist John E. Reid was largely responsible for changing the field of interrogation when he released *Criminal Interrogation and Confessions*, in which he detailed a method of interrogation known as the Reid Technique. The Reid Technique is one of the most widely taught interrogation models in North America (King & Snook, 2009); interrogations using the Reid technique are designed to elicit a confession. The Reid Technique consists of a behavior analysis interview (BAI) and a subsequent 9-step interviewing model. The BAI is the keystone of the Reid Technique and is anchored on the idea that there are behavioral cues to deception (e.g., body language, eye contact, speed of speech). The BAI consists of a 15-item questionnaire designed to help the police determine who is innocent and who is guilty and must be subjected to an interrogation. Police are instructed to use the BAI in the pre-custodial interview to determine which subjects are being deceptive and should be targeted for the subsequent Reid-based interrogation.

The first step in the Reid Model of Interrogation involves the interrogator directly confronting the suspect with a belief in their guilt, accompanied by an emphasis on the benefits of telling the truth (Inbau et al., 2013). The goal is for the suspect to believe that their guilt is known to be true

by investigators. During this step, interrogators are instructed to evaluate the suspect's verbal and nonverbal responses for indicators of deception (more on deception detection later in the chapter). Kassin and Fong (1999) noted that no evidence supported the diagnostic value (i.e., the extent to which behavioral cues can accurately distinguish between deception and truth) of the behavioral cues that investigators are trained to observe. Specifically, observers were unable to reliably differentiate between true and false denials. Moreover, those that were trained in the deception cues were significantly less accurate, more confident, and more biased towards seeing deception compared to untrained observers (Kassin & Fong, 1999). A follow-up study showed taped interview clips of 14 suspects (12 male and 2 female; 4 were juvenile) to experienced police detectives, asking them to note what verbal and nonverbal deception cues they use to judge guilt, whether they believed the suspect was guilty and their confidence in their judgement (Mann et al., 2004). Researchers noted the same biased responses; police tended to have more confidence in their judgements, but were biased towards seeing guilt, making them less accurate in their judgements overall (Mann et al., 2004; Meissner & Kassin, 2002).

During the second step of the Reid Technique, the investigator is encouraged to introduce a theme—i.e., a belief about the reason for the crime's commission including moral excuses, minimizing the seriousness of the crime, or blaming another person or the circumstance, a set of practices known as minimization (Inbau et al., 2013). Minimization techniques, while deemed admissible by courts in the United States and Canada (Inbau et al., 2013) have been linked to increased incidents of false confessions (Horgan et al., 2012; Kassin & Kiechel, 1996; Russano et al., 2005). Russano and colleagues (2005) developed a novel paradigm aimed at assessing the diagnosticity (i.e., the likelihood of obtaining a true confession over a false confession) of common coercive interview practices, specifically examining how minimization techniques impact interview outcomes. In their study, undergraduate students were asked to complete logic tasks alongside a confederate, who either asked for assistance from the participant to cheat, or did not ask the participant for assistance. Participants in both conditions were accused of cheating, and interviewed using minimization (e.g., "I'm sure you didn't realize what a big deal it was"). The interviewer lessened the seriousness of the participant's offence by making statements that expressed sympathy or concern, by offering moral excuses, or by proposing an explicit deal (e.g., where participants could confess to the crime, allowing them to settle the matter quickly). Specifically, when minimization techniques or the explicit deal were used, the number of both true and false confessions increased, negatively impacting the interview's diagnosticity. The diagnosticity rating was 7.64 when no tactics were used, compared to 4.50 when minimization was used, and 2.02 when

minimization techniques and the explicit deal were used (Russano et al., 2005). Higher diagnosticity ratings are desired, as such implies a particular technique is more likely to elicit a true (cf. false) confession.

Step three of the Reid technique involves discouraging denials of guilt by returning to the previously presented theme and interrupting suspects during their denial of the crime (Inbau et al., 2013). The manual notes that innocent suspects and guilty suspects will react differently to this tactic. For example, innocent suspects are believed to be forceful in their denials and maintain eye contact, while guilty suspects are believed to be more hesitant and defensive in their denials. Step four involves overcoming a suspect's secondary line of defense: reasons they would not or could not have committed the crime. Notably, Inbau and colleagues (2013) stated that the excuses are normally only offered by guilty suspects. During step five, the investigator is trained to display sincerity in what they say and increase the physical closeness between them and the suspect. Step six involves recognizing that the suspect may have a passive mood, as they weigh the benefits of telling the truth, which is supposedly reflected in changes in nonverbal behavior. In step seven, the investigator uses an alternative question, or a suggestion of a choice to be made by the suspect concerning a component of the crime. For example, the officer may state "Did you intend to kill her or was it just an accident?" (Inbau et al., 2013). Both alternatives offered are the functional equivalent of an incriminating admission. The final two steps involve the interrogator getting verbal and written confessions, respectively.

Together, it is evident that each step of the Reid Technique serves to solidify an interviewer's belief in suspect guilt. In turn, the Reid Technique leaves investigators vulnerable to the effects of tunnel vision and puts innocent suspects at risk for false confessions (Moore & Fitzsimmons, 2011).

False Confessions

Before the science of DNA in 1984, the legal community had little knowledge on false confessions. It was not until geneticist Alec Jeffreys applied DNA sequencing to identity-based testing that research on false confessions began to erupt in the academic community (Saad, 2005). Over the next several years, sobering statistics began to emerge regarding the prevalence of false confessions across North America. To date, more than 360 DNA-based exonerations have taken place across the United States alone (Cooper et al., 2019), representing 15% of the 2,359 exoneration cases documented in the National Registry of Exonerations (NRE; Saber et al., 2022). Recent data from the Innocence Project (2023) revealed that approximately 30% of the organization's exoneration cases were the result of false confessions.

There are four main types of false confessions discussed in the literature: (1) voluntary, (2) coerced-internalized, (3) coerced-compliant, and (4) coerced-reactive. First, voluntary false confessions refer to omissions that are made without prompting from law enforcement (Kassin & Wrightsman, 1980). There are several reasons why an individual may voluntarily confess to a crime they did not commit. Most explanations speak to an underlying psychopathology (e.g., desire for attention, self-punishment, guilt, delusion, mental illness). In some cases, however, voluntary confessions are made in the interest of protecting someone (i.e., friend, family member), or because of some perceived tangible gain (e.g., publicity, monetary reward).

The second and third types of false confession involve coercive interviewing methods. Coerced-internalized false confessions, for example, occur when highly coercive interviewing tactics end up being so convincing that the accused themselves eventually end up believing they committed the crime in question (Chapman, 2012). Research investigating the internalized subtype of false confessions suggests that many false confessors experience a lack of confidence in their recollection of an event, a phenomenon referred to as memory distrust syndrome (MDS; see Gudjonsson, 2017 for a detailed analysis). Antecedents such as suggestibility, lack of confidence, and undue trust in authority are found to compound one's risk of making a coerced internalized false confession. Finally, coerced-compliant false confessions occur when the accused is persuaded into an omission of guilt using coercive interrogation tactics (Kassin, 2008). Coerced-compliant false confessions differ from coerced-internalized in the sense that the accused offers the omission out of compliance instead of an internalized belief that they are guilty. Often, coerced-compliant confessions happen when an individual confesses to evade the psychological stress of an interrogation, to avoid punishment (i.e., expectation of leniency), or because of an expectation of harsh punishment if they do not confess (Kassin, 2008).

More recently, a fourth type of false confession has been proposed by scholars: coerced-reactive false confessions. Coerced-reactive confessions occur when individuals confess to avoid or escape coercive actions that come from sources outside of police and the interrogation room (e.g., pressure from criminals; McCann, 1998). For example, a gang member who confesses to a crime committed by another offender under threat of death by fellow gang members would be considered a coerced-reactive confession. These confessions are distinct from voluntary and coerced-compliant false confessions as the motivation to confess is external to the interrogation, meaning it is not related to coercive interviewing practices, nor is the confession voluntary, as the individual would not likely confess without the influence of the external pressure (McCann, 1998).

Humanitarian Interviews

In response to critical issues emerging from the accusatorial interrogation methods, some countries have seen a shift in policy for sanctioned interrogation practices. Recently, a group of academics, practitioners, and policy makers collaborated on a global set of guidelines and universal protocol for investigative interviewing (Mendez et al., 2021). These guidelines are aimed at facilitating a transition away from accusatorial, coercive interviewing practices toward humanitarian, evidence-based interviewing practices. In contrast to accusatorial interviewing, humanitarian interviewing is rooted in ethical practices, encourages rapport building, a relaxed atmosphere, and the use of empirically supported memory enhancement techniques. Ultimately, the aim of the humanitarian interview is to obtain detailed and accurate information about a crime to conduct an efficient and effective investigation.

In England and Wales, a national review of investigative interviewing practices was conducted following several high-profile wrongful convictions (e.g., the Birmingham Six, the Guildford Four), which led to the introduction of the PEACE Model of Investigative Interviewing (see Clarke & Milne, 2001; Milne & Bull, 1999 for a comprehensive overview of the PEACE Model of Investigative Interviewing). PEACE was named for the steps of the interviewing model, that include Planning and Preparation, Engage and Explain, obtain an Account, Closure, and Evaluation.

PEACE: Planning and Preparation

Before the beginning of an interview, the PEACE model requires investigators to plan and prepare for the interview. In this initial step, interviewers are encouraged to develop an extensive written plan of their questions, investigative objectives, and practical arrangements for how the interview should proceed (e.g., a route map of questions, plans for obstacles and eventualities; Snook et al., 2014). The model also recommends investigators gather as much information as possible about the interviewee (e.g., presence of mental illness, family and social ties, financial situation) to help inform the interview.

PEACE: Engage and Explain

Once a suspect interview begins, interviewers enter the Engage and Explain phase of the interview. This second phase is characterized by engaging the interviewee in a personalized conversation (e.g., building rapport, self-disclosing) and providing a breakdown of the interview process. Some key elements of this stage include a clear statement of suspect's legal rights and an explanation of reason(s) for the interview.

PEACE: Account

Following the completion of the Engage and Explain phase, interviewers are expected to enter the Account phase of the interview which aims to obtain a clarified account from the suspect. During this phase, suspects are encouraged to provide an uninterrupted account of experienced events. Open-ended (i.e., tell, explain, describe) and focused prompts (i.e., who, what, when, where, how) are encouraged so that the interviewer can obtain detailed and accurate information from the interviewee (Snook et al., 2012). The account phase also encourages interviewers to address inconsistencies and discrepancies in a respectful and ethical manner.

PEACE: Closure

The fourth phase of the PEACE model is Closure. Considered as the conclusion of the interview, the interviewer provides an overview of everything that was discussed, including explaining what will happen in the future. This phase also gives the suspect an opportunity to add or correct any information (Snook et al., 2014).

PEACE: Evaluation

The PEACE model extends beyond the end of the interaction with the suspect as it encourages interviewers to self-evaluate their performance and request feedback from colleagues.

In the past two decades, researchers have extensively studied the effectiveness and the impact of the accusatorial and humanitarian interview models. Multiple benefits have been identified regarding the use of humanitarian models, such as PEACE, for interviewing. First and foremost, such models do not contain unethical or coercive strategies that were observed in cases of false confessions (Snook et al., 2014). Thus, a humanitarian interview ensures the respect of human rights while also avoiding the risk of inadmissible statements. Secondly, multiple researchers have conducted both observational and experimental studies that provide empirical evidence supporting the use of humanitarian models. In their meta-analysis, Meissner et al. (2014) found humanitarian interviewing approaches to be more effective in eliciting information compared to accusatorial interrogations. For example, an experimental study by Evans et al. (2013) examining intelligence-gathering interrogations found that participants questioned in the information-gathering approach provided more details and confessed more frequently compared to those in the accusatorial interrogation. A third piece of evidence supporting the humanitarian interviewing approach was revealed in studies considering the offender's perspective. Specifically, an offender's decision to cooperate during an interview is influenced by the

style of interviewing adopted by the officer (Snook et al., 2014). When asking offenders about their perspective regarding an experienced interrogation, research has found that offenders display increased resistance and denials when questioned in an accusatorial style (Holmberg & Christianson, 2001). Taken together, benefits for using information-gathering approaches over accusatorial approaches have been widely demonstrated. However, changes in term policy and training are still lacking in many countries (Snook et al., 2010).

Virtual and Automated Interviewing Systems

Arguably the next stage in the evolution in investigative interviewing practice is the use of virtual and automated interviewing environments and systems. Recent advances in technology—virtual reality and artificial intelligence—have created additional avenues for eliciting information in the context of investigative interviews as well as interviewer training. Further, the context of the COVID-19 global pandemic led to an increased adoption of technology and resulted in investigative interviews making their way to online virtual platforms (e.g., interviewing via Zoom or similar videoconferencing software; Vieth et al., 2020). This shift in interviewing context posed sudden and unexpected difficulties that required investigators to adjust. While very few studies have been conducted on virtual and automated interviewing prior to the pandemic, it appears we are on the cusp of the next stage of the evolution of interviewing practices.

Virtual Interviewing Benefits and Challenges

Virtual environments, or computer simulations, have been shown to be useful in contexts related to investigative interviewing. For example, computer mediated communication has demonstrated success for increasing self-disclosure (Baccon et al., 2019; Joinson, 2001) and reducing social pressure (Herrera et al., 2018) relative to face-to-face interactions. The use of virtual environments has also proven useful for gathering reliable and accurate information, albeit in other contexts than investigative interviewing (e.g., counseling, health; Kang & Gratch, 2010, 2012; Peiris et al., 2000).

The use of virtual environments for interviewing also may prove useful for investigators who are required to interview witnesses living in remote areas, as opposed to bringing them to the police station. That is, using virtual environments to conduct remote interviews has allowed investigators to save time and resources, as well as to question witnesses within shorter delays of the incident (Hager, 2020). Notably, a witness's recollection of the details of a crime can be forgotten or interfered with following

significant delays. For example, people tend to mentally replay events or discuss events with others, often adding and removing details without even knowing it. This type of rehearsal only increases one's confidence about what happened, but negatively affects the accuracy of their memory (Busey et al., 2000). Therefore, conducting the interview as soon as possible after the event can have great benefit for the accuracy of witness's recollection of details. Additionally, virtual interviews remove the cost and difficulty associated with travel for interviewees (Hoogesteyn et al., 2020).

One of the potential issues associated with virtual interviewing is the ability to build rapport may be hindered. Rapport is fundamental to facilitating cooperation and disclosure during investigative interviews (Gabbert et al., 2021). There are nonverbal cues that people typically use when building connections with others such as posture mirroring, eye contact, and physical touching (e.g., handshakes) which are difficult or impossible to replicate in virtual settings. Common techniques that investigators use to control physical distance between the interviewee and to provide practical needs (e.g., offering food, water) also are limited.

Dion Larivière and colleagues (2022) developed a study to measure the ability to build rapport in an online interviewing context. To build rapport, interviewers were instructed to start the interview with attempts to show empathy as well as with self-disclosure by asking participants about their experiences with online learning during the pandemic. Throughout the interview, the interviewer addressed the participant by their first name, used a gentle tone, smiled, and attempted to keep their gaze toward the screen and the webcam when possible. The interviewer was also instructed to sit upright in a visibly relaxed and open posture. These behaviors were to be maintained throughout the entire interview. Conversely, the interview guide for the no-rapport condition began with five close-ended filler questions that did not emphasize personal interest (e.g., "Is the webcam integrated into this computer?"). Throughout the interview, the interviewer did not address the participant by their first name—they used a flat tone of voice and made no effort to smile or attempt to keep their gaze toward the screen and the webcam. The interviewer was sitting upright and was facing slightly offscreen. The interviewer was instructed only to make comments that helped progress the interview and ask clarification questions when needed. Their results showed that in the rapport condition, the interviewer was able to successfully build rapport in a virtual environment, which led to more accurate reporting from the participants. Therefore, interviewers can build rapport effectively in a virtual environment using approaches like those found effective in in-person interviews.

A second potential issue with virtual interviewing is technology and connection-related problems. The unpredictability of technology can interrupt the flow of an interview and prevent the transmission of visual and

verbal cues due to lagging and/or freezing. These technological issues also can affect the ability to record the interview, which is crucial for admissibility in court. Safety and confidentiality are also potential concerns with virtual interviewing. Virtual interviewing is often done from the comfort of one's home, which means other people may be present. The presence of other individuals could be distracting for the interviewee, but more crucially problematic in cases where the victim and suspect live in the same home (e.g., domestic abuse). For example, a suspect may be forcing the victim to say certain things in the interview.

Avatar-based Interviewing Benefits and Challenges

Researchers have also begun to examine the efficacy of avatar-based interviewing (e.g., Pompedda et al., 2022; Taylor & Dando, 2018). Avatar-based interviewing involves a virtual computer representation of a user, who can be completely customized in terms of age, tone of voice, realistic features, etc. The benefit of using avatar-to-avatar interviewing is that each avatar can be tailored to best fit the interviewee. Avatar-to-avatar based interviewing, while under-researched, is beginning to show promise for practical use. For example, research has shown that avatar-to-avatar communication results in high levels of interpersonal trust (Segal et al., 2022).

In perhaps the first study to test the efficacy of interviewing adult witnesses using avatars, Taylor and Dando (2018) examined eyewitness' memory performance for interviews conducted in a virtual environment (avatar-to-avatar) using either a virtual reality headset, or in-person (face-to-face). Specifically, participants watched a mock crime video (1 minute and 45 seconds) depicting a car theft and were interviewed about what they remembered from this event. Their results showed that those interviewed with avatars recalled more correct information about the crime and made fewer errors in their recall compared to those interviewed in-person.

More recently, Dando et al. (2022) examined participants' memory as a function of being interviewed via avatars or face-to-face, and whether rapport could be successfully built using avatars. Specifically, the authors engaged in several attentive verbal (e.g., self-disclosure) and physical (e.g., eye contact, nodding) behaviors to build rapport with the interviewees in both interviewing modalities. Their results showed that rapport was successfully established in avatar-based interviews. Further, participants interviewed in the virtual environment with rapport building practices outperformed those interviewed in-person by providing more, and more accurate information about the crime they witnessed.

Avatar-based interviewing has also proven beneficial for interviewing children. For example, in child sexual-abuse cases, the only tangible evidence police can obtain is from statements the child makes in an interview

(Elliot & Briere, 1994). Research has suggested that children stay more engaged and may feel more comfortable when talking to animated characters (i.e., puppets) versus real people (Eder, 1990). Avatar-based interviewing also has the flexibility of programing certain body language and reactions into the avatars (Pompedda et al., 2022). The ability to program certain nonverbal behaviors is especially important when interviewing children because children are highly susceptible to influence and they naturally look for cues of approval when speaking with others (Howe, 2000).

Research has also examined the utility of avatar-based interviews for training interviewers. The main advantage of this approach is that the child avatars can be programmed with pre-defined memories, which means what “actually” happened is known and therefore specific feedback can be given to the trainee (Haginoya et al., 2021). Recently, Pompedda and colleagues (2022) conducted a meta-analysis of the effectiveness of providing feedback on avatar-based interview training. Their analysis included nine studies with over 2,200 interviews. Overall, their results revealed strong support for the use and efficacy of avatar-based training—trainees showed robust effects of increasing their use of appropriate question types and decreasing their use inappropriate question types during interviews.

While the meta-analysis by Pompedda and colleagues (2022) is promising for the future of avatar-based training, researchers have argued that child avatars for interview training still requires significant development (Powell et al., 2022). For example, there needs to be development around the sets of questions that child avatars can respond to, as well as development of the range of responses that the avatars can produce (Brubacher et al., 2015; Pompedda et al., 2015). Also, current iterations of the avatars are often reported as visually primitive and lacking in realism (Wang & Ruiz, 2021). While avatar-based interview training tools certainly hold promise for significant advances in delivering investigative interview training, further research and development of these tools are required. Further information is also needed on the admissibility of such interviews in court cases.

Artificial Intelligence Interviewing

Recent developments in technology have led to the development of Spot—an online digital misconduct reporting tool (see www.talktospot.com). Spot, developed as a tool for reporting harassment in workplace contexts, is an artificial intelligence bot that conducts interviews via text-chat. Spot is designed to recognize keywords (e.g., names, dates, places) to ask relevant follow-up questions. An advantage of a tool such as Spot is its timing—individuals can access it immediately following an event, which may prevent false memories and increase accuracy of reporting. While artificial

intelligence tools, such as Spot, offer a promising technological advancement to investigative interviewing, we are unaware of any research examining its efficacy or reliability.

The Evolution of Deception Detection Techniques

The ability to solve crimes quickly and efficiently, often with minimal resources, is an important issue faced by investigators. One investigative skill that has received a great deal of attention in the literature is the ability to detect deception. Deception detection research and practice has a rich history, with methods dating back to ancient times. For example, in the Medieval ages, holding onto a hot iron or being tied to a sack and submerged in cold water were commonly employed methods of deception detection. If the subject was burned by the iron or floated in the water, they were deemed dishonest (Sullivan, 2001). The use of dangerous tests was common in English Medieval courts as methods were based in theology and the belief that honesty would prevail in the person on trial (Ford, 2006). There have been several instruments developed to increase investigators' ability to detect deception (e.g., polygraph, voice stress analyzer). There are three main factors that deception detection instruments examine to accurately detect fabricated statements: nonverbal behaviors (e.g., eye movement), physiological responses (e.g., sweating), and verbal behaviors (e.g., an individual's vernacular) (Vrij & Fisher, 2016; Vrij et al., 2004). Before discussing the specific factors of deception, it is helpful to know about some theoretical approaches to deception detection.

Theoretical Approaches to Deception Detection

There are two primary theoretical approaches to deception detection—emotional theories and cognitive theories.

Emotional Theories of Deception

Ekman and Friesen (1969) developed the emotion-based approach to deception detection. This approach stated that lying causes emotions different from those experienced when telling the truth. For example, a liar may experience guilt about telling a lie, delight in fooling someone, or fear of being caught in a lie, while a truth teller may not experience any guilt or fear. The emotional approach suggests that experiencing emotions when lying can lead to a leakage of these emotions, thus giving away concealed information. This theory applies exclusively to lies of consequence, as they are more likely to produce emotional responses that can be signaled

behaviorally. In early iterations of the nonverbal leakage theory, lies are signaled in different parts of the body. Because people are aware of their face and able to exercise control over their facial expressions, deception is unlikely to manifest in the face aside from fleeting signs of expressions that are being suppressed, called micro-expressions. According to Ekman and Friesen (1969), the legs and feet are a primary source of leakage and deception cues because we are less aware of what our feet or legs are doing. Leakage in the legs or feet could include behaviors such as soothing leg squeezing, flirtatious leg displays, or restless flight movements. Ekman suggested that the less aware we are of a behavior, the more likely the behavior is to signal a lie.

Subsequent research has not supported Ekman and Friesen's leakage theory (e.g., Burgoon, 2018; Vrij et al., 2019). More recent iterations of emotion theories have focused on the role of micro-expressions—involuntary emotional leakage that presents itself as fleeting facial expressions (i.e., lasting only one-quarter to one-half of a second). Research has shown, however, that there is often a disconnect between emotions that are displayed and those that are felt. As such, deception does not necessarily produce negative emotions, which, in turn, do not necessarily signal deception (Hoque et al., 2012). Researchers have found that micro-expressions do not occur often enough to be useful. For example, a study by Porter and ten Brinke (2008) found that only 2% of emotional expressions that were coded could be labeled as micro-expressions; further, they appeared equally in the expressions of liars and truth tellers (Porter et al., 2012; Porter & ten Brinke, 2008). Other studies have found that liars and truth-tellers exhibit different emotional responses than would be expected given Ekman's theory of micro-expressions. For example, Pentland and colleagues (2015) found that in a concealed information test (described in detail later in this chapter), liars showed less contempt and more intense smiles than truthful individuals, which is at odds with the fundamental assumption that it is impossible for a liar to conceal their true nature (Porter et al., 2012).

Jordan and colleagues (2019) examined whether the micro-expression training tool (METT; see Ekman, 2006 and Paul Ekman Group, 2011 for more information on this tool) could improve an individual's ability to identify micro-expressions and use them for lie detection. Their results showed that METT-trained participants performed *worse* than chance on identifying micro-expressions. Further, the METT-training individuals did not perform better than untrained or bogus trained (i.e., trained on the Interpersonal Perception Task; see Costanzo & Archer, 1989) individuals. While all individuals in the study had high confidence in their ability to detect deception, their actual ability to do so was no better than chance. Similar results have been found with other micro-expression training research

(e.g., Zloteanu et al., 2021) and deception detection training in general (Driskell, 2012). While training to detect deception has very little empirical support, such training has unfortunately been implemented in practice. For example, training to recognize and identify micro-expressions is used in the Screening Passengers by Observation Technique (SPOT) program—used by airport security organizations (see Higginbotham, 2013; Smith, 2011; Weinberger, 2010 for more info on the SPOT program).

Overall, the convergence of evidence shows that micro-expressions are not a reliable indicator of deceit, and that training to detect micro-expressions does not improve veracity judgements. What is also troubling is that it appears that Ekman has yet to publish empirical data showing evidence that micro-expressions can be used to distinguish truth-tellers from liars (Vrij et al., 2014).

Cognitive Theories of Deception

Cognitive theories of deception are based on the knowledge that lying is more cognitively demanding than telling the truth as liars must maintain both internal and external consistency in their stories (Zuckerman et al., 1981). Internal consistency is when the facts line up and make sense with each other; external consistency is when the facts make sense with other people's understanding of the event. The cognitive demand thought to be associated with lying led Zuckerman and colleagues to hypothesize that liars would exhibit the following cues: longer response times to questions, more hesitations, and fewer hand movements to accompany speech. Zuckerman and colleagues developed the Four-Factor Theory of Deception, which stated: (1) arousal is greatest when lying; (2) emotional affect is associated with guilt; (3) the cognitive aspects of lying are more complex than truth telling; and (4) liars attempt to control both verbal and nonverbal behaviors to avoid being caught. For further understanding on cognitive theories of deception, see the Interpersonal Deception Theory (Buller & Burgoon, 1996), the Preoccupation Model of Secrecy (Lane & Wegner, 1995), the Activation-Decision-Construction Model (Walczyk et al., 2003), and Mohamed and colleagues' (2006) neurological model of deception.

Lying is cognitively demanding, especially during a police interview (Granhag & Strömwall, 2002; Vrij, 1998). Two cognitive theories that consider the difficulty of interviews as advantageous to detecting deception are the Content Complexity Theory and the Attempted Behavioral Control Theory. Content Complexity Theory encompasses the demands of an interview, wherein a truthful person's account will be more complex and have more detail than a liar's account (Vrij, 2000). Liars will present fewer details (cf. truth tellers) as they are better able to maintain a simple story

while under the pressures of an investigative interview (DePaulo et al., 2003). To increase the pressure on liars in an interview, research has found that increasing cognitive load is effective (Vrij et al., 2006, 2008, 2012). To increase cognitive load, the interviewer gives cognitively challenging tasks to the suspect (e.g., provide an account from its end to beginning), with the goal of causing the suspect to make mistakes and deviate from their initial account (Vrij et al., 2006). Content Complexity Theory is supported by research studies that use the number of details provided by a suspect as a cue to deception, meaning liars tended to provide fewer details compared to truth tellers (DePaulo et al., 2003; Granhag & Strömwall, 2002; Nahari et al., 2019). Attempted Behavioral Control Theory rationalizes that as liars try to appear calm in an interview, their endeavors are seen as rigid and unnatural (Vrij, 1998). Essentially, liars actively try not to fidget, break eye contact, show too much emotion, or pause for too long because they believe doing so will aid in appearing innocent. However, research has found that liars' behaviors are dissimilar to that of truth-tellers: they smile, pause, blink, and avert their gaze less than truth-tellers (DePaulo et al., 2003; Granhag & Strömwall, 2002).

Cues for Detecting Deception

As mentioned, there are three main factors that deception detection instruments examine when attempting to detect fabricated statements: nonverbal behaviors (e.g., eye movement), physiological responses (e.g., sweating), and verbal behaviors (e.g., an individual's vernacular) (Vrij & Fisher, 2016; Vrij et al., 2004). Each of these factors are reviewed briefly below.

Nonverbal Cues to Detecting Deception

A wealth of research has indicated that nonverbal cues are not reliable indicators of deception. Specifically, a meta-analysis by Bond and DePaulo (2006) examined more than 200 deception detection studies, finding an average lie-truth discrimination rate of 54%. The meta-analysis also noted that truthful messages were more often judged correctly compared to deceptive messages, meaning that in settings where virtually no lies are told, there are substantially higher discrimination rates compared to settings where virtually all statements were lies (Bond & DePaulo, 2006). A follow-up meta-analysis examined the role of individual differences in people's abilities to detect deception (Bond & DePaulo, 2008). The authors found similar results to their earlier meta-analysis; specifically, results accounting for the range of variance in people's abilities still produces chance levels of accurate deception detection.

Physiological Cues to Detecting Deception

The first record of using physiological cues to detect deception is from ancient China (c.1000 BCE), where dry rice powder was used as a lie detector mechanism (Cotton, 2014). The accused was asked to chew on the powder and if it was dry, they were determined to be a liar; conversely, if the powder was wet, they were deemed to be telling the truth (Cotton, 2014). The rice powder technique depended on physiological responses, which were mistakenly associated with deceptive persons (e.g., dry mouth and decreased salivation), yet those same symptoms may also be exhibited by anxious, fearful, or fight-or-flight states (Vicianova, 2015). Despite the misattribution of these physiological responses to deception, they gained increasing popularity in the late 1800s, which led to the development of the polygraph.

Using the assumption that certain physiological responses predicted deceit, Cesare Lombroso invented the first recorded polygraph device in the 1880s, which measured systolic blood pressure using a simple cuff (Vicianova, 2015). William Marston improved on this technology (Marston, 1917); in the following decades, Leonard Keeler and John Larson combined galvanic skin response (the production of sweat in the fingertips), heart rate, and respiratory rate into the first modern polygraph patented in the 1930s (Saxe et al., 1985). The polygraph went through many more decades of development, all of which mapped the physiological symptoms of systolic blood pressure, heart rate, galvanic skin response and respiratory rate (Ford, 2006). The general logic behind the polygraph is that during questioning, liars would have raised blood pressure, sweat more, and show an increased heart rate and respiratory rate compared to truth-tellers (Saxe et al., 1985). Overall, the combination of physiological analysis and an interview with intense questioning was thought to produce an accurate confession (Horvath, 2019; Horvath & Reid, 1971).

COMPARISON QUESTION TEST

The most frequently used polygraph test is the control question test (CQT), also commonly referred to as the comparison question test (Ben-Shakhar, 2002; Honts & Reavy, 2015). The CQT is administered in several stages (Ben-Shakhar, 2002). First, the interviewer establishes rapport and obtains basic information. During this stage, the subject is provided the opportunity to freely recall details of the incident. Based on the information provided, questions are formulated, and the examiner and the subject discuss these questions. The purpose of the formulation and discussion phase is to ensure the subject understands all the questions, and for the examiner to ensure the subject will respond to the questions with “yes” or “no”

(Vrij, 2008). Next is the question phase, which is run through in several iterations to allow for the responses to be averaged across different test instances. Questions asked fall into three categories: (1) irrelevant or neutral questions (e.g. “Do you live in Canada?”), which are not included in the analysis of the results; (2) relevant questions that are directly related to the crime in question (e.g. “Did you steal the purse?”); and (3) control questions, which are unrelated to the crime in question, but concern likely transgressions in the past (e.g. “Have you ever lied to your parents?”). The control questions are designed to force everyone to give a deceptive response, but are vague enough to cover likely transgressions, such as lying within social settings. The use of control questions acts as a baseline for establishing the subject’s deceptive responses, which will then be compared to responses to the relevant questions. The premise of this comparison is that guilty subjects will react more strongly to the relevant questions compared to control questions, and the opposite will be seen for innocent subjects (i.e., they will react more strongly to the control questions than the relevant questions), as they are telling the truth for the control questions (Honts & Reavy, 2015).

Field studies have shown that the CQT is relatively good at correctly classifying guilty suspects, with an accuracy rate of approximately 80%. However, the CQT has a tendency for false positives, incorrectly classifying innocent suspects as guilty (Vrij, 2008). The validity of the CQT is hotly debated among scholars, with some stating that the test has a significant positive association with interpersonal deception detection, and that experimental studies that show the that the CQT is effective are generalizable to investigative settings (see Honts et al., 2020 for a review). However, other scholars believe that little has changed in polygraph research since a landmark report (National Research Council, 2003), which asserted that claims of the CQT’s accuracy are unfounded. Researchers acknowledge that while the CQT has an accuracy above chance, its error rate is unknown and little progress has been made in polygraph research to address these concerns (Iacono & Ben-Shakhar, 2019).

GUILTY KNOWLEDGE TEST

The second type of polygraph test is the concealed information test (CIT), more widely referred to as the guilty knowledge test (GKT). Lykken (1959) developed this test originally to address concerns that practitioners had regarding the CQT. The GKT suggests that people suppress or attempt to inhibit their knowledge of details related to the event/objective in question (Lykken, 1959). As such, the GKT aims to detect concealed knowledge that only the guilty suspect will know. The GKT involves presenting suspects with multiple-choice questions (e.g., “What weapon was used in the

crime: a gun, a knife, a rope?”), with the belief that the guilty suspect will recognize the correct answer and have a greater physiological response to the correct choice compared to the other responses (Meijer & Verschuere, 2015). Innocent suspects should have similar physiological responses to all options since they lack the knowledge that the guilty suspect would have (MacLaren, 2001).

Unlike the CQT that has a tendency of producing false positives and incorrectly classifying innocent suspects as guilty, the GKT is more accurate at classifying innocent suspects (Vrij, 2008). While most psychologists consider the GKT to be based on sound reasoning (75% compared to 33% who consider the CQT to be based on sound principles), researchers have serious concerns about GKT's validity (Iacono & Lykken, 1997). For example, if the correct response stands out in any way, the validity of the test can be seriously compromised. In addition, innocent suspects must not know the correct option, or they would risk providing guilty responses. An innocent individual providing a “guilty” response could occur because investigators inadvertently provide the suspect with privileged information during an investigation, or because the media released details of a crime. On the other hand, the guilty suspect must also know the answer for the test to work. Thus, if the suspect failed to perceive the targeted detail of the crime, they may provide responses indicating innocence, despite their true guilt (Honts, 2004). Moreover, recent examinations of the GKT have found gender differences in the magnitude of responses, suggesting that the GKT may not have robust effects. For example, males showed higher skin conductance and respiration than females when responding to critical GKT items; conversely, heart-rate responsivity was higher in females compared to males (Staunton & Hammond, 2011). Findings have also suggested that there are substantial variations between the psychophysiological measures used to evaluate the GKT, indicating there is a lack of equivalence between the measures (Staunton & Hammond, 2011).

CRITIQUING THE POLYGRAPH TEST

Despite its shortcomings, the polygraph is a widely used tool. For example, polygraph tests are mandatory in the UK for domestic abuse suspects and terrorists, however, the polygraph outcome evidence is not admissible in court (UK Government, 2022). In the United States, polygraph evidence admissibility varies by state and is often determined based on recommendation from *Frye v. United States* (1923), such that the results are admitted if they have gained “general acceptance” (Myers et al., 2006). In Canada, police continue to use the polygraph test for law enforcement investigations and employee screening purposes. However, according to *R. v. Béland* (1987) and much like the UK, polygraph evidence is not admissible in

court. A major reason for making polygraph evidence inadmissible is the well-studied fact that jurors are highly influenced by the presentation of polygraph evidence in court, more so if accompanied by a confession (Han, 2016; Kassin, 2008; Vrij, 2008). Additional reasons for the inadmissibility of polygraph evidence include the subjectivity of the technology measuring physiological responses, and the variation in obtained responses from the test (i.e., results vary based on gender; Staunton & Hammond, 2011). Furthermore, a report published by the National Research Council's Committee to Review the Scientific Evidence of the Polygraph (National Research Council, 2003) critiqued the validity of admissions and confessions from polygraph examinations, informing interviewers of the poor accuracy of polygraph examinations. The authors warned against pairing interrogation methods designed to obtain confessions with polygraph tests, and recommended the number of false confessions obtained by the test be considered as evidence against its utility.

Verbal Cues to Detecting Deception

In the mid-2000s, researchers and practitioners began working on interviewing protocols and models to better elicit verbal veracity cues from interviewees (Vrij et al., 2022). Using language to discriminate between truthful and deceptive statements requires several assumptions to be made: first and foremost, the basic assumption is that there are distinct and observable differences in the language use of those who tell the truth versus those who lie (Smith, 2011). However, as Smith stated, this assumption is problematic as these distinct indicators do not appear to exist. There are several potential explanations for the lack of verbal indicators of deception, though the primary reason is differences in language acquisition: language development is not universal. Factors that affect language acquisition include socioeconomic status, occupation, education, and culture (Hoff & Tian, 2005; Landry et al., 2001). For example, those raised in impoverished conditions may not have the same opportunities as those raised in families with higher socioeconomic status (e.g., attend better schools). As such, an individual's vernacular is subject to diverse factors which ensure a departure from universality. Due to this departure, it cannot be assumed that people mean or understand the same thing by individual words. Language is an inherent social construct which varies among cultures, locations, and the social norms present in an individual's environment.

While there are pitfalls for verbal (linguistic) deception detection, meta-analyses reported that such cues do provide discriminability beyond chance levels (Hauch et al., 2017; Oberlader et al., 2016; Vrij et al., 2017). As mentioned in the Cognitive Theories section, the number of details provided by a suspect is a well-studied verbal cue to deception (DePaulo

et al., 2003; Granhag & Strömwall, 2002; Vrij et al., 2000, 2006). Liars also are less likely to make errors when speaking or provide unusually ordered statements, both of which are common in truth-tellers (DePaulo et al., 2003). Higher voice pitch, slower rate of speech, and fewer speech disturbances (e.g., umm, ah) are also verbal cues that have been associated with deception (Vrij, 2000). Interestingly, liars do not engage in spontaneous correcting, admitting they do not remember something during their recall or going back and correcting something they previously said.

Unanticipated Questions Approach

The unanticipated questions approach to eliciting verbal cues to deception is based on the finding that liars tend to spend time preparing their account prior to an interview, by predicting the questions they will be asked and rehearsing answers to those questions (e.g., Liu et al., 2010; Hartwig et al., 2007; Lancaster et al., 2013). This strategy initially showed promise as research has shown that advanced planning makes lying easier, and lies that are planned usually contain fewer cues of deceit than spontaneous lies (DePaulo et al., 2003). Interviewers can exploit liars' tendency to prepare their responses by asking unanticipated questions, specifically questions that truth-tellers will be in a comparatively better position to answer when compared with liars. For example, in a study by Vrij et al. (2009), liars and truth-tellers were asked about an alleged visit to a restaurant. The opening questions were anticipated (e.g., "Can you tell me in as much detail as possible what you did while you were in the restaurant?"), while subsequent questions were unexpected (e.g., "In relation to the front door, where at the table did the waiter stand when serving your food?"). Raters performed at chance when classifying the truth-tellers and liars based on the opening questions. However, when classified based on the unanticipated questions, coders were able to correctly classify 60% of truth-tellers and 80% of liars (Vrij et al., 2009).

While initially promising, recent studies have found the relationship between unanticipated questions and response details does not improve veracity judgements significantly above chance level (Parkhouse & Ormerod, 2018). Specifically, observers were more accurate at distinguishing between liars and truth-tellers when judging transcripts of unanticipated questions, with the effect being stronger for spatial (e.g., "Please describe this room,") and temporal questions (e.g., "Please describe the task in full, but now in reverse order,") compared with planning questions (e.g., "Explain the steps you would have taken had you not been able to access Room B via the main door"). Together, the studies suggested that the unanticipated questions approach is not as robust and effective as initially believed.

Reality Monitoring

Reality monitoring (RM) refers to people's ability to discriminate between self-experienced (true) and imagined events (Johnson & Raye, 1981). RM research is based on the notion that real experiences are the result of perceptual processes, whereas imagined events are the result of reflective processes. As such, memories of real events are believed to contain more contextual information (i.e., temporal and spatial details) and perceptual information (e.g., details relating to the five senses), compared to memories of imagined events. In 1992, it was first suggested that RM could be used to distinguish between real and imagined events, and thus as a tool for distinguishing between truthful and deceptive accounts (Alonso-Quecuty, 1992). Research has examined the efficacy of RM in detecting deception, with an average accuracy of 75% and comparable efficacy for statements made by children and adults (Bogaard et al., 2019; Masip et al., 2005; Sporer, 2004).

Verifiability Approach

One of the newer approaches for interviewing to elicit verbal cues to deception is the verifiability approach. The verifiability approach relies on two assumptions; first, liars prefer to avoid mentioning details that can be verified, and second, liars often include less detail in their account than truth-tellers, though liars are aware that the level of detail is important for being assessed as truthful (Nahari et al., 2014). This approach relates to how liars attempt to navigate around this dilemma—that is, providing sufficient information but not details that can be checked for veracity. For example, a liar may state that on the way home, they chatted with a stranger, wearing a grey jacket in the park about the weather. While appearing to contain some detail, because the individual cannot be identified the veracity of this statement cannot be checked. Studies have shown that liars consistently report fewer verifiable details compared to truth-tellers (Nahari et al., 2014; Nahari & Vrij, 2014; Verschuere et al., 2020).

Statement Validity Assessment

The Statement Validity Assessment (SVA) is one of the most widely used techniques for detecting deception and assessing veracity based on verbal content. The underlying premise of the SVA is that statements based on actual experience will differ in content from statements based on fabrications (Amado et al., 2015). The SVA consists of four stages: (1) case-file analysis, where hypotheses are made about the source of the statement (i.e., based on actual experience versus fabrications); (2) a semi-structured interview is conducted; (3) the statement is assessed for credibility using

a criteria-based content analysis (CBCA), which is based on a set of 19 criteria (see Steller & Köhnken, 1989); and finally, (4) using a validity checklist, where alternative explanations to the CBCA outcomes are considered (Steller & Köhnken, 1989; Vrij, 2000). The criteria of the CBCA are then grouped into five categories: general characteristics, specific contents, peculiarities of content, motivation-related content and offense-specific elements. The presence of each of the 19 criteria is rated, and the stronger the presence of each criterion, the stronger the hypothesis that the memory is based on a personal experience rather than a fabrication (Köhnken, 2004). Laboratory studies on the SVA show an overall accuracy rate of 73%, performing equally well at detecting truthful and fabricated accounts (Vrij, 2008).

Strategic Use of Evidence

Strategic use of evidence (SUE) is a combination of questioning and evidence disclosure tactics that separates liars from truth-tellers by their verbal differences. Guilty suspects have an information management dilemma in an interview—they must simultaneously suppress critical information while asserting innocence (Hartwig et al., 2014). SUE capitalizes on suspects' cognitive strategies, how they control information, and their conduct in the interview (Hartwig et al., 2014). An interviewer will employ the SUE technique by sequentially revealing pieces of evidence in the interview and encouraging the suspect to explain them (Granhag, 2010). The explanations can be identified as accurate or inaccurate by comparing them to the suspect's initial statement, or to other evidence known by the interviewer. Over the course of the interview, the cognitive demand on the guilty suspect accumulates, causing them to produce inconsistencies between their story and the evidence that the interviewer presents. These inconsistencies are called statement evidence inconsistencies (SEIs) or within-statement inconsistencies (WSIs) and can be used to confirm the accuracy of a suspect's statement. According to Granhag and Hartwig (2015), a proper use of the SUE technique will force suspects to continually revise their perceptions of what evidence the interviewer has and lead them to make SEIs or WSIs.

By forcing a suspect to account for evidence presented against them, SUE can be used to identify whether suspects are being avoidant with information and deceptive, or verbally forthcoming and truthful (Granhag, 2010). Therefore, SUE improves veracity judgements, unlike other deception detection techniques, by separating guilty suspects from innocent ones by identifying SEIs and WSIs (Hartwig et al., 2014). Out of all the deception detection techniques used by interviewers in the present day, SUE is likely to be the most promising. The SUE technique relies on four key

principles: (i) how the suspect perceives the evidence; (ii) what counter-interrogation strategies suspects may use; (iii) whether presenting the evidence causes inconsistencies in their detailed account; and (iv) the suspect's overall perspective of the evidence (Granhag & Hartwig, 2015).

Overall, the timing of evidence disclosure is crucial to the success of the SUE technique. The most recent meta-analysis on evidence disclosure timing confirmed that later disclosure of evidence in a suspect interview produces more SEIs (Oleszkiewicz & Watson, 2021), however fourteen of the fifteen studies included in this meta-analysis included an author from the original SUE study, meaning the findings should be interpreted with caution.

Automated Deception Detection Systems

The accuracy of humans' ability to detect deception hovers around chance level (Bond & DePaulo, 2006, 2008; Bond et al., 2014; DePaulo et al., 2003; Levine et al., 2005; Zuckerman et al., 1981). Thus, researchers have recently begun studying whether machine learning methods can better discriminate between liars and truth-tellers. Much like the research on virtual and automated interrogations, the research on automated deception detection systems is also in the early stages.

Automated deception detection systems typically involve researchers developing machine learning models to analyze transcripts, spoken statements, or written texts (Kleinberg et al., 2018). Various linguistic features of the text are analyzed to predict the outcome of the text being truthful or deceptive. For example, researchers have used variables from the Linguistic Inquiry and Word Count (LIWC) software (Pennebaker et al., 2015) and other classification algorithms (e.g., random forests, Naïve Bayes; Kleinberg & Verschuere, 2021) to attempt to discriminate between truth-tellers and liars.

In a recent study by Kleinberg and Verschuere (2021), the authors tested whether the combination of machine learning and human judgement could improve deception detection accuracy. Following the outcome of the machine learning (automated) judgement on whether a statement was classified as truthful or deceptive, human raters had the opportunity to fully overrule the automated judgement or adjust it within a given boundary. Their results showed that humans were unable to add meaningful contributions to the automated judgements. That is, while the automated judgements produced an overall accuracy of 69%, human intervention reduced the judgement accuracy rates to chance levels. The results of their study are likely explained by the "truth bias"—that is, our tendency to assume we are being told the truth and that we experience a larger bias towards classifying messages we hear as truthful (Bond & DePaulo, 2006).

A recent study by the RAND corporation (Posard et al., 2022) examined the use of machine-learning methods for detecting deception in security clearance background investigations. Although the machine learning techniques were examined from a lens of security clearance background investigations, the techniques can still arguably apply for interrogations as well. Participants were asked to read a vignette about someone who leaked classified information and were then assigned randomly to either tell the truth during the interview about the vignette they read, or lie about the vignette they read. The machine learning models they developed used a range of model classifications including aspects such as word counts, metadata (average word length), and stance (characteristics of emotion and doubt) to attempt to discriminate between truthful and deceptive responses. The accuracy of their machine learning models for discriminating between truthful and accurate statements ranged from 62% to 75%.

Recently, the European Union (EU) began implementing an artificial intelligence program in select EU airports to detect deceit—named iBorderCtrl (Campbell, 2020). The iBorderCtrl involves a two-phase procedure. First, passengers register with an on-line system designed to collect various pre-travel information (e.g., visa, passport, purpose of trip). Second, when crossing the border, iBorderCtrl is used to assist border guards with identifying passenger risks. Part of the second stage involves the Automatic Deception Detection System (ADDS). ADDS is purported to “quantif[y] the probability of deceit in interviews by analyzing interviewees’ nonverbal micro-gestures.” However, the fundamental issue, as described above, is that micro-expressions have not been proven to be a reliable indicator of deceit. Thus, a system that relies on unvalidated information to make consequential judgements will undoubtedly provide questionable decisions to border agents (for more comprehensive reviews of the potential issues associated with iBorderCtrl, see Sánchez-Monedero & Dencik, 2020; Jupe & Keatley, 2020).

Overall, the use of machine learning to discriminate between truthful and deceptive statements is still in its early stages. The current evidence suggests that the performance of automated deception detection systems ranges between 64% and 84% (Burns & Moffitt, 2014; Fornaciari & Posio, 2013; Kleinberg et al., 2018; Mihalcea & Strapparava, 2009; Pérez-Rosas & Mihalcea, 2014).

Future Directions

Research and practice in automated and virtual systems for interrogation and detecting deception are experiencing a rapid growth due to factors such as the availability of new technologies and contexts that demand it (e.g., global pandemic, continued proliferation of online communication).

Based on the research reviewed in this chapter, we are incredibly enthusiastic about what the future holds for research and practice in advancing virtual environments and automated systems for interrogations and deception detection. We believe there are abundant opportunities to advance both research and practice in the next stage in the evolution of interrogation and deception detection. However, we strongly caution against the immediate adoption of such tools and techniques until more research is conducted, and until significant underlying issues are considered and addressed in future research.

A significant issue to address in both the interrogation and deception detection literatures is that most of the research has been conducted with Western, educated, industrialized, rich, and democratic (WEIRD) participants (Hope et al., 2021; Vrij et al., 2022). Culture—“the distinctive customs, values, beliefs, knowledge, art, and language of a society or a community” (American Psychological Association, 2020)—plays a significant role in how information is communicated (Hope et al., 2021). For example, factual, direct, and linear communication is characteristic of Western (individualistic) cultures (Gudykunst et al., 1988; Hall, 1976; Triandis & Suh, 2002). However, collectivist cultures tend to be more indirect and context-oriented in their communication, building on shared understanding, meaning, and relationships (Beune et al., 2009; Gelfand et al., 2001). Cross-cultural interviews can include communication features unlikely to occur in Western-based strategies for gaining cooperation. For example, Gelfand and colleagues (2015) noted the importance of negotiation strategies addressing “honor,” an important concept in some Middle Eastern, Latin American, and African cultures, which functions as a commodity to be gained or lost within communication contexts. Failure to take account of these features results in inadequate interviewing that can directly affect the outcomes of investigations. Unfortunately, interviewing policies for cross-cultural engagement have not kept pace with basic research identifying important cultural communication dimensions, such as individualism/collectivism (Hofstede, 1984; Hofstede & Hofstede, 2001). Communication problems arising from cultural differences are an increasing contemporary challenge for investigators (Duffey, 2000). Unless investigators can navigate cultural differences, there exists a serious threat to developing generalized automated and virtual tools and techniques for interrogation and deception detection.

Another fundamental issue that needs to be addressed is the external validity of the research. Like many areas of psychological research, researchers have criticized the external validity of deception detection (i.e., the applicability to real-world situations). In standard deception detection research, participants provide truthful or deceptive statements regarding their opinions, emotions, or involvement in a past event (e.g., a mock crime).

This context represents a low-stakes situation, in that it has little to no consequences for failing to deceive the experimenter. On the other hand, the situations encountered outside of the lab (e.g., an interrogation or police interview) are high-stakes, such that the consequences for failing to convince individuals of your innocence are severe. Researchers have argued that deceptive behavior is different in high- and low-stakes situations, meaning it would not be reasonable to draw conclusions about real-world high-stakes situations, such as a police officer's ability to detect deception in an interview, using data from laboratory experiments (Miller & Stiff, 1993). Studies which have examined high stakes lies in interrogation settings have found that realistic target materials seem to slightly improve people's ability to detect lies, however the pattern is unclear (Mann et al., 2004).

The other part of the external validity criticism is that the context of assessment lacks realism. In many deception detection studies, participants watch video-clips of the target and make judgements based on those clips. Participants in laboratory studies lack background information and direct interactions with suspects, where they could ask questions that they deem necessary to determine the suspect's veracity (Hartwig et al., 2004). A meta-analysis by Hartwig and Bond (2011) examined the generalizability of laboratory results and the extent to which deception cues are robust across situations. The researchers investigated whether the detectability of lies varied depending on their accompanying emotion, the severity of perceived consequences (i.e. high- versus low-stakes situations), and whether the motivation to lie was external (e.g. instructed by the experimenter to lie) or internal (e.g. decided to lie themselves). The meta-analysis determined that the weakness of cues to deception is not exclusive to laboratory studies, and that deception detection cues fail to reliably detect deception in field studies as well (Hartwig & Bond, 2011). Alternatively, results suggested there was no basis for the belief that laboratory studies of deception detection produce unrealistic results unapplicable to real-world deception detection settings (e.g., interrogations). Instead, researchers have identified general problematic research practices in the deception detection literature—namely, low powered studies, selective reporting, and too many positive results reported within the literature (Luke, 2019). Criticisms of deception detection cite the realism of the target material (i.e., the lies and truths), and the realism of the situation, as causes for concern (Ben-Shakhar & Nahari, 2018; Hartwig & Bond, 2011).

Conclusion

Our answer to the question “Do automated and virtual interrogation and deception detection systems work?” is “not yet.” However, we are

looking forward to what the future holds. We urge researchers who study automated interrogation and deception detection systems to rigorously test their systems before public and widespread implementation. Premature implementation of such systems has the potential to cause severe harm—wrongfully convicted individuals or individuals deemed to be deceitful when they are being truthful. Researchers must first identify reliable and valid cues to deceit before we can automate the detection of such behaviors.

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