Science or pseudoscience? A distinction that matters for police officers, lawyers and judges

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Abstract

Scientific knowledge has been a significant contributor to the development of better practices within law enforcement agencies. However, some alleged 'experts' have also been shown to have disseminated to police officers, lawyers and judges, information that is neither empirically tested nor supported by scientific theory. The aim of this article is threefold: to provide organisations within the justice system an overview of a) what science is and what it is not, b) what constitutes empirically driven, theoretically founded and peer reviewed approaches, and c) how to distinguish science from pseudoscience. Using examples in relation to nonverbal communication, we aim to exemplify how not everything presented as comprehensively evaluated is methodologically reliable for use in the justice system.

Keywords: Pseudoscience, investigative interviews, trials, justice system, nonverbal communication.

Science or pseudoscience? A distinction that matters for police officers, lawyers and judges

Scientific knowledge has been a significant contributor to the development of better practices within law enforcement agencies. Academics often collaborate with various agencies to evaluate and advise upon empirically or theoretically supported approaches which support the pursuit of justice (e.g., The High Value Detainee Interrogation Group [HIG], Federal Bureau of Investigation, 2018). They are often called to provide expert testimony within criminal trials (Brodsky, 2013) and can be key advisors to both prosecutors and defence lawyers.

However, some alleged 'experts' have also been shown to have disseminated ambiguous information to members of the justice community; that is, information that is neither empirically tested nor supported by scientific theory (e.g., Lilienfeld & Landfield, 2008). Because of a lack of scientific literacy (e.g., Fraigman, 2006; Moreno, 2003; Redding, Floyd, & Hawk, 2001; Tadei, Finnilä, Reite, Antfolk, & Santtila, 2016), and clear guidance on how to differentiate what science is and what it is not, individuals within the justice system may not have the required information which allows them to identify questionable information, or even pseudoscience. Pseudoscience has been referred to as the romanticism of science and is often based on little more than myths and legends (Allchin, 2004):

> Pseudoscience is necessarily defined by its relation to science and typically involves subjects that are either on the margins or borderlands of science and are not yet proven, or have been disproven, or make claims that sound scientific but in fact have no relationship to science (Shermer, 2013, p. 203).

Therefore, understanding what pseudoscience is, and how to distinguish it from science, is crucial in evaluating approaches presented by so-called experts. It is also required as a means to develop better professional practice. In addition, the use of pseudoscience by members of the

justice community can result in adverse human, social and economic consequences (i.e., Denault & Jupe, 2017; Kageleiry, 2007; Lilienfeld & Landfield, 2008; Makgoba, 2002; White, 2014).

However, despite the rising popularity of pseudoscience (Heller, 2017), the justice system does not have a standardised advisory system which informs police officers, lawyers and judges on how to differentiate science from pseudoscience. The aim of this article is threefold: to provide organisations within the justice system an overview of a) what science is and what it is not, b) what constitutes empirically driven, theoretically founded and peer reviewed approaches, and c) how to distinguish science from pseudoscience. Using examples in relation to nonverbal communication, we aim to exemplify how not everything presented as comprehensively evaluated is methodologically reliable for use in the justice system.

How to distinguish 'nonscience' from science

> Philosophers nowadays recognize that there is no sharp line dividing sense from nonsense, and moreover that doctrines starting out in one camp may over time evolve into the other. For example, alchemy was a (somewhat) legitimate science in the times of Newton and Boyle, but it is now firmly pseudoscientific (movements in the opposite direction, from full-blown pseudoscience to genuine science, are notably rare). (Pigliucci & Boudry, 2013b, para. 12).

Whilst distinguishing pseudoscience from science can be difficult, there are methods to aid in making a distinction. For example, several indicators which would be suggestive of 'nonscience' have been suggested, such as a lack of falsifiability, misuse of scientific vocabulary, absence of connectivity, extravagant claims, argument from authority, and lack of self-correction (e.g., Damer, 2013; Denault, 2015; Lilienfeld & Landfield, 2008). However, whilst such cautionary advice may entice some individuals to raise questions regarding

ambiguous approaches, in practice, pseudoscientists can often provide what appear to be convincing counterarguments. Let us take the example of synergology.

Synergology

Synergology is a self-proclaimed "scientific discipline to read body language" (Synergology, The Official Website, n.d.a, our translation). Proponents of synergology, for example, have claimed that their approach allows individuals to be able to identify specific states of mind from nonverbal behaviour supposedly based upon the rigorous analysis of thousands of videos (e.g., Axelrad, 2012; Jarry, 2016, 2018; Moody, 2014; Turchet, 2012). Training sessions in synergology are offered to health, education, justice and security professionals by synergologists (individuals who receive 200-plus hours training in synergology) (e.g., Synergology, The Official Website, n.d.b). Recently, synergology has been marketed as a discipline to prevent terrorist attacks:

> Whether used for crowd monitoring, interrogation, videos analysis or through surveillance cameras, the observation of a suspect or of an interaction between people could prevent terrorist attacks, manage a crisis and more. Synergology's analysis of non-verbal behaviour is a logical complement to the important work of the various security officers in reading a threat. (Gagnon, 2018, para. 10)

According to the founder of synergology, "Emotions hold a fundamental place in our lives as human beings. They are at the root of all our decisions, yet they are, paradoxically ignored by mainstream science" (Turchet, 2012, p. 17). Synergology, however, purports to offer a way to understand them: "Scratching the body or the face is an expression of repressed emotions" (Turchet, 2012, p. 150). For example, according to the founder of synergology, "The joints give flexibility to the body. The brain moves the hands there each time that the ability to

be or an interest in being flexible is questioned … When someone scratches the inside of the left elbow, the need to become flexible, to change the rhythm of the relationship, is tackled" (Turchet, 2012, p. 182-183). Synergology associate such meanings with all parts of the face and the body. However, to our knowledge, claims specific to synergology have not been subjected to peer-review and replication. When their approach is in the spotlight, however, proponents of synergology can be fairly proficient at counterarguments.

Regarding the lack of falsifiability, proponents of synergology assert that claims specific to their approach are falsifiable, and therefore scientific (Quebec Association of Synergology, n.d.). This misuse of scientific vocabulary will not be apparent if members of the justice community do not know what falsifiability is (Popper, 1968). Falsifiability refers to theories or hypotheses which have the potential to be shown as false through contradictive statements or observation and is an essential component of the scientific method. This means that if the theories or hypothesis are not thoroughly justified, falsifiability cannot be demonstrated, and if they do not allow for testable predictions, they are not falsifiable (Popper, 1968).

However, claims specific to synergology are not published in peer-reviewed papers. According to Philippe Turchet, the founder of synergology, and other synergologists, "a synergologist has no peer" (Jarry, 2016), so nobody but a synergologist can criticise synergology. Therefore, a statement regarding falsifiability is misleading, more so considering that falsifiability as a demarcation criterion is still debated (Pigliucci & Boudry, 2013a) and that pseudoscientists can offer falsifiable claims (e.g., graphologists) (Lilienfeld & Landfield, 2008). This is more apparent when you consider that the founder of synergology also stated that "what we absolutely do not believe in within synergology is experiment, because body language is made in such a way that when we participate in an experiment, it does not work" (European

Institute of Synergology, 2015, our translation) and argued that "you can't use replication when dealing with humans" (Jarry, 2016).

Regarding the absence of connectivity, pseudoscientists can combine their claims with common sense and scientific assertions, which may suggest their theories or hypothesis were not developed in isolation (e.g., Denault & Jupe, 2017). For example, proponents of synergology regularly assert that one should not jump to conclusions whilst observing others (e.g., Moody, n.d.), something that has been advised by academics in the past (e.g., Ekman, 1992). However, they subsequently make extravagant claims such as the holding of your right hand with your left hand "indicates a control of the speech, a filtering of the words used and the rationalization of the emotion" (Gagnon, 2018, para. 8). Several other extravagant claims were made, such as "Our methods permit the detection of 80 percent of lies in this test called "guilty/innocent" … The success rate is 90 percent when people work in a group" (Turchet, 2012, p. 322).

However, if judicial officers do not understand the science around the topic within training sessions they receive, these common sense and scientific assertions will likely appease suspicions of extravagant claims, more so if pseudoscientists describe it as a scientific discipline. This is even more likely if pseudoscientists refer to important practitioners and organisations to which they have provided the training sessions (Denault, Larivée, Plouffe, & Plusquellec, 2015). Although such an argument from authority should raise questions, it can also be quite persuasive to naïve observers. Ultimately, if pseudoscientists are questioned regarding their arguments from authority, retaliated statements can infer that academics are themselves using arguments from authority when they refer to peer-reviewed papers and that their criticism is unfounded, notably because their approach allegedly evolved, thus counteracting a supposed lack of self-correction (Denault, 2018).

In view of the foregoing, for dubious claims to be rejected by members of the judiciary, there needs to first be an understanding of what constitutes peer-reviewed papers. This includes an understanding of the publishing process; that is, how academics will empirically or theoretically study a specific aspect within the justice system, and then have their work scrutinised by members of the scientific community before and after it is published in a scientific journal (Ware, 2008).

For example, after scientific academics have run an empirical study, it is then reported in a manuscript that is inclusive of all parts of their research process. They thoroughly explain in writing how they conducted their study, the results they obtained, how they carried out the analysis of their results, their conclusions but also any limitations of their analysis (Shipman, 2014). The reasons for work being so rigorously reported is to allow readers to draw sound evaluative conclusions from a manuscript, considering any pitfalls the work may have, and to allow for replication; that is, can another researcher take the manuscript and run the same study again to either support or question the original findings? This is a critical part of the publishing process within psychological science (Asendorpf et al., 2013; Lindsay, 2015). The manuscript is subsequently submitted to a scientific journal, also known as a peer-reviewed journal, and subjected to a critical review from experts on the subject of the manuscript. Following the critical review, the manuscript may be rejected, the authors may be asked to revise and resubmit with major or minor amendments or it may be accepted for publication. Once a manuscript is accepted, it is then published in accordance with the journal specifications and becomes a peer-reviewed paper. This is a process that has been adapted over the years to suit the ever-growing need for a stringent evaluation process (Spier, 2002).

It should be noted, however, that the publication process is lengthy at best. Scientific journals can take 3-6 months to undertake an initial review of a manuscript, and then depending on subsequent requests, a further 3-9 months for amendments and a further 3-6 months for publication. These are approximate figures, which will vary within disciplines and from one scientific journal to another. Rejection rates also differ between scientific journals. The American Psychological Association (APA) journals have an average rejection rate of 70%. For example, *Psychological Review* has a rejection rate of 86% and *Professional Psychology: Research and Practice*, a rejection rate of 56% (American Psychological Association, 2018).

There are of course times where manuscripts are not reviewed by individuals with the specific credentials required (Elmore, 2017) and weakly founded articles do slip through into scientific journals, but such instances will likely decline with the recent transition to more open and transparent science (Open Science Collaboration, 2012). This allows other academics worldwide to evaluate peer-reviewed papers critically, provide commentary and in cases of serious misrepresentation, papers may be retracted. The humanities, however, have been shown to be one of the most stringent in terms of the peer review process (Huisman & Smits, 2017). Therefore, if judicial officers understand what peer-reviewed papers are, it is easier to reject approaches claimed to be “rigorous” or “scientifically founded”, but that were in fact never subject to the process of critical appraisal of knowledge.

From the field to the laboratory and back to the field

To appreciate the value of knowledge in peer-reviewed papers, one should also understand what comes prior to the publication process. Research by academics often starts in the laboratory, using willing participants and then moves into the field; that is, the techniques found to have solid empirical support in the laboratory are then evaluated within the justice

system itself. This often stems from problems previously identified within the field. A prime example of this is the Cognitive Interview (CI). After the RAND corporation evaluated the criminal investigation process, it was clear that the testimony given by witnesses was key in the collection and evaluation of evidence (Greenwood & Petersilia, 1975). From this, Geiselman, Fisher, MacKinnon and Holland (1986) developed the CI as a means to increase the accuracy of eyewitness memory. After a series of initial laboratory studies, the CI was then tested in the field (Fisher, Geiselman, & Amador, 1989) and has now become standard practice within police investigations and part of continuous development, including within the detection of deception (Dodson, Powers, & Lytell, 2015; Frosina et al., 2018; Sooniste, Granhag, Strömwall, & Vrij, 2015). Further examples of laboratory to field approaches include that of sex offender treatment programs (Friendship, Mann, & Beech, 2003; Brown, 2005), and violent offender treatment programs (Serin, Gobeil, & Preston, 2009).

However, standard practices within police investigations can lack empirical evidence; that is, despite having been examined under the empirical magnifying glass, they may not have ben replicated, nor the findings supported. One primary example of this is the Behavioral Analysis Interview (BAI). The BAI claims to be similar to the CI but uses behaviour-provoking questions to try to elicit specific behavioural indications of a suspect's guilt or innocence (Inbau, Reid, Buckley, & Jayne, 2013). The BAI relies heavily on nonverbal and (para)linguistic cues that deception research has shown to be unreliable (DePaulo et al., 2003). In addition, as noted by Vrij, Hope and Fisher (2014), a field study often cited in defence of the BAI was only able to establish ground truth in two out of 60 cases that were examined (Horvath, Jayne, & Buckley, 1994). In addition, when empirically tested, studies have found the opposite of what the BAI claims to elicit from interviewees (Vrij, Mann, & Fisher, 2006). It has also been shown to be

based upon little more than 'common sense' assumptions (Masip, Barba, & Herrero, 2012). A further example of a tool lacking empirical evidence referred to by Vrij, Hope and Fisher (2014), is that of 'micro-expressions' which are commonly used amongst practitioners within the detection of deception. Whilst micro-expressions were first introduced by Ekman (1992) as a symptomatic indication of 'leakage', there is no evidence that micro-expressions are valid cues to detect deception in real-time (Honts, Hartwig, Kleinman & Meisner, 2009) or that they occur often (Porter & ten Brinke, 2008). Furthermore, their use (nonverbal behaviour) could be detrimental to one's ability to detect lies (Bond & DePaulo, 2006).

The 'anything goes' nature of pseudoscience

Organisations within the justice system do use empirically or theoretically supported approaches (e.g., Leone, 2015; Memon, Meissner, & Fraser, 2010). However, some implemented approaches lack empirical evidence. In more perturbing cases, police officers, lawyers and judges may resort to pseudoscience: that is, bodies of information that may appear to be scientific but, in reality, lack the characteristics of scientific knowledge (Lilienfeld, Lynn, & Lohr, 2014). As aforementioned, if members of the justice community are not advised about the publishing process, pseudoscientists can be fairly proficient at counterarguments. In addition, pseudoscientists can use several other fallacious arguments to achieve maximum support for their approaches.

For example, pseudoscientists might argue that their approaches are supported by a select number of articles, theses, or books, and that they are reliable due to their acceptance by important organisations (Denault, Larivée, Plouffe, & Plusquellec, 2015). However, if upon reading such literature, it becomes apparent that there is no empirical or theoretical support, or that the steps leading to the conclusions are not thoroughly justified (be this methodologically or

through evaluation), the implementation of their approaches remains merely destitute of vision. In addition, such reference to important organisations – often known as 'name dropping' – is detrimental by nature. Doing so lends support to the notion that they might be unable to distinguish pseudoscience from science and may not understand the role that science plays in developing better professional practice. Fallacious arguments from pseudoscientists can also address negative comments in a way that attempts to prevent criticism from members of the scientific community. They can engage in *ad hominem* attacks, that is, opposition to an argument "by questioning the personal circumstances or personal trustworthiness of the arguer who advanced it." (Walton, 1987, p. 317). For example, if academics raise concerns regarding a particular pseudoscience, having not attended its associated seminars, pseudoscientists might assert that the academic do not have the required understanding to be able to criticise, and as such, their criticism is of no value. If they did indeed attend the seminars, pseudoscientists might suggest that the academics raise concerns out of obscure or malicious reasons (Denault, 2018; Larivée, 2014; Shermer, 2002). Pseudoscientists might even state that they are criticised due to their revolutionary approach and refer to a quote dubiously attributed to the German philosopher Arthur Schopenhauer: "All truth passes through three stages. First, it is ridiculed. Second, it is violently opposed. Third, it is accepted as self-evident." (Shallit, 2005).

However, as Sagan (1979) rightly points out, "the fact that some geniuses were laughed at does not imply that all who are laughed at are geniuses. They laughed at Columbus, they laughed at Fulton, they laughed at the Wright brothers. But they also laughed at Bozo the Clown" (p. 75). Unfortunately, if organisations within the justice system encounter and use pseudoscientific approaches, the above fallacious arguments can still be as persuasive as counterarguments to criticism (Blancke, Boudry, & Pigliucci, 2017).

Although it would be a comfortable assumption to blame organisations within the justice system who resort to pseudoscience, such a conclusion would be far too simplistic. There is no clear guidance for police officers, lawyers and judges on how to recognise empirically driven, theoretically founded and peer-reviewed approaches from ambiguous ones. Moreover, if organisations within the justice system do not have access to empirically or theoretically supported approaches, and are turning to what is easily accessible, part of the responsibility lies with academics (Colwell, Miller, Miller, & Lyons, 2006; Denault et al., in press). If they do not adequately disseminate scientific knowledge or develop clear guidance on how to recognise what is and what is not science, it is not surprising that 'nonscience' finds its way to members of the justice community, the more so considering the large body of questionable information on forensic science being broadcast by popular media streams.

Whilst there has been an influx of evidence-based practices within medicine being infiltrated into popular media, and thus the mainstream (Sackett, Rosenberg, Gray, Haynes, & Richardson, 1996), the same is not true for justice practices. In fact, television programs have contributed to distorted knowledge amongst the public, such as the CSI Effect (Byers & Johnson, 2009; Schweitzer & Saks, 2007). The CSI Effect is commonly referred to as having had a detrimental effect on jurors' arbitrary beliefs regarding forensic evidence.

> Prosecutors, judges and police officers have noted what they believe to be a so-called CSI effect whereby the popular television forensics programs have led jurors to have unreasonable expectations for the quality and quantity of physical evidence. (Houck, 2006, p. 86)

In addition, evidence has suggested that watching the popular television series *Lie to Me* actually decreases individuals' ability to detect deception (Levine, Serota, & Shulman, 2010).

The programme *Lie to Me* is heavily built upon the concept of micro-expressions as a tool to detect deception, which has little or no empirical support within the scientific literature (e.g., Vrij et al., 2017). Whilst such examples are not directly related to pseudoscience *per se*, they exemplify the ease with which questionable information is able to have a wide and unfavourable effect on the audience.

Science or pseudoscience? A working example of nonverbal communication

When a decision is required as to whether or not particular approaches should be presented to members of the justice community, an initial assessment should be required as to whether or not the concepts disseminated are in fact empirically driven, theoretically founded and peer reviewed. If the evidence which supports the approaches does not meet these requirements, or if the approaches have the potential to cause serious harm (e.g., Denault et al., in press), then questions should arise over their place within the justice system. However, counterarguments to criticism and fallacious arguments can appear compelling. Pseudoscience can seem logical and seem to be adequately supported. As Lakatos (1980) notes, even the most plausible and comprehensible statement may stem from pseudoscience whilst the most incomprehensible or confusing may be of high scientific significance:

> Thus a statement may be pseudoscientific even if it is eminently 'plausible' and everybody believes in it, and it may be scientifically valuable even if it is unbelievable and nobody believes in it. A theory may even be of supreme scientific value even if no one understands it, let alone believes in it. (Lakatos, 1980, p. 1)

Therefore, before an initial assessment, police officers, lawyers and judges should be advised to refrain from too readily concluding that the approaches are scientifically valuable. This call to caution is all the more important considering pseudoscientists can combine their

claims with common sense and assertions (e.g., Denault & Jupe, 2017). However, if ambiguous approaches do find their way into the justice system, could this result in dire consequences?

Let us take the example of a training session offered to judicial officers by a so-called expert. The approach asserts that different facial expressions and gestures are associated with particular states of mind, irrespective of the fact that there are no peer-reviewed papers that support such associations. Even if claims from the pseudoscientist appear to be extraordinary, any suspicion was appeased because of a reasonable underlying principle; a combination of scientific and pseudoscientific assertions gives the impression that the approach is grounded in science. For example, the so-called expert asserts that no single facial expression or gesture gives away lies, such as Pinocchio's nose, an empirically supported assumption (Vrij, 2008), and that one should look for a combination of nonverbal cues and ask further questions to substantiate initial observations before making definitive conclusions as to whether or not someone is lying. However, whilst this advice may appear to be empirically driven, theoretically founded and peer-reviewed, evidence suggests that it is not (e.g., DePaulo et al., 2003; Hartwig & Bond, 2011; Vrij, 2008).

Since the 1960s, thousands of peer-reviewed papers have addressed the issue of nonverbal communication (Burgoon, Guerrero, & Floyd, 2016; Knapp, Hall, & Horgan, 2014; Moore, Hickson, & Stacks, 2014). The overall scientific consensus is that there is no cue akin to Pinocchio's nose when it comes to detecting deception (Vrij, 2008). Of the cues that have been shown to have an association, the correlation is often weak (DePaulo et al., 2003). Therefore, the advice to look for a combination of nonverbal cues in face to face interactions, and to ask further questions, can be inadequate, and more importantly, unsafe during investigative interviews and trials.

For example, the pseudoscientist may assert that hiding the hands, scratching the nose, lowering the head, closing the mouth, and looking in specific directions are nonverbal indicators of deceit (Denault, 2015). However, many of these indicators stem from stereotypical beliefs regarding deceptive behaviours (Bogaard, Meijer, Vrij, & Merckelbach, 2016; The Global Deception Research Team, 2006). In fact, research suggests that indirect methods are more likely to result in higher accuracy rates when making deception judgements (ten Brinke, Stimson, & Carney, 2014; cf. Bond, Levine, & Hartwig, 2015). Furthermore, some individuals, whilst achieving quite high accuracy rates when making deception judgements, mention indicators that were not present during the interview they observed (Jupe, Akehurst, Vernham, & Allen, 2016). Therefore, considering there is no conclusive scientific evidence for the above indicators and that nonverbal indicators of deception are generally faint and invalid, decisions made by judicial officers by looking for a combination of nonverbal cues not supported by peer-reviewed evidence are likely to be inaccurate (Denault & Jupe, 2017; DePaulo et al., 2003; Otgaar & Howe, 2017).

In addition, if members of the justice community ask further questions to substantiate their initial veracity judgments, they could unknowingly adapt their interaction to confirm their belief that witnesses, or suspects are lying. This is known as a confirmation bias; that is, “the seeking or interpreting of evidence in ways that are partial to existing beliefs, expectations, or a hypothesis in hand” (Nickerson, 1998, p. 175).

For example, confirmation bias within investigative interviews often results in guilt-presumptive questioning which, when listened to by independent evaluators, often leads to a self-fulfilling bias (Hill, Memon, & McGeorge, 2008). In addition, the initial presumption of guilt based upon questionable information, or even pseudoscience, may mean that those involved in

the investigative process fail to initiate dialogue with suspects which would enable the elicitating of verifiable (Nahari, 2018) or reliable forms of information (Vrij & Granhag, 2012). During trials, a confirmation bias can lead to erroneous credibility assessments (Porter & ten Brinke, 2009; Porter, ten Brinke, & Gustaw, 2010). Considering that "Credibility is an issue that pervades most trials, and at its broadest may amount to a decision on guilt or innocence" (*R. v. Handy*, 2002, p. 951), the implementation of ambiguous approaches, or even pseudoscience, is also of serious concern. This manifestation of a confirmation bias can be totally unintended, but nevertheless can result in adverse human, social and economic consequences (Hill et al., 2008; Vrij et al., 2017).

Conclusion: Evidence is not only a matter of investigation

The aim of this article was to provide the justice system with an overview of what science is and what it is not, what constitutes empirically driven, theoretically founded and peer-reviewed approaches, and how to distinguish science from pseudoscience. Whilst we have outlined the importance of empirically or theoretically supported approaches, there is no reason to question the intentions of most pseudoscientists. Advocates of pseudoscience often do so with the primary intention of assisting police officers, lawyers and judges. However, good faith is not a synonym of good practice. When approaches are implicitly or explicitly presented as scientific or when science is used as a backdrop to give them authenticity and influence, the justice system needs to acknowledge that evidence is not only a matter of investigation. Before the presentation of training sessions, police officers, lawyers and judges should systematically request and evaluate the supporting evidence. It is recommended that organisations within the justice system set up a joint advisory committee of academics and practitioners that would request and evaluate the supporting evidence of training sessions offered to police officers, lawyers and judges. This

would allow an assessment to be made as to whether approaches are in fact empirically driven, theoretically founded and peer-reviewed.

Finally, the implementation of approaches that may appear to be scientific should initiate careful consideration, even if their subject matter is listed as a soft skill. “Soft skills are interpersonal qualities, also known as people skills, and personal attributes that one possesses” (Robles, 2012, p. 453). For example, one might intuitively believe a soft skill such as nonverbal communication has a lower value than several other skill sets. However, nonverbal communication can have a ubiquitous influence on a number of daily decisions made by police officers, lawyers and judges, including those made during investigative interviews and trials (e.g., Denault, 2015; Abbe & Brandon, 2014; Broaders & Goldin-Meadow, 2010). Therefore, organisations within the judicial system should be acutely aware of the importance of distinguishing pseudoscience from science and understanding the role that science plays in developing better professional practices. When thousands of peer-reviewed papers address a subject matter, the scientific knowledge should, at the very least, be understood and considered. Failing to do so could ultimately result in miscarriages of justice (e.g., Kozinski, 2015).

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This article does not contain any studies with human participants or animals performed by any of the authors.

References

Abbe, A., & Brandon, S. E. (2014). Building and maintaining rapport in investigative interviews. *Police Practice and Research: An International Journal, 15*(3), 207-220. http://doi.org/10.1080/15614263.2013.827835

Allchin, D. (2004). Pseudohistory and pseudoscience. *Science & Education*, *13*(3), 179-195. https://doi.org/10.1023/B:SCED.0000025563.35883.e9

American Psychological Association (2018). Summary report of journal operations, 2017. *American Psychologist, 73*(5), 683-684. http://dx.doi.org/10.1037/amp0000347

Asendorpf, J. B., Conner, M., De Fruyt, F., De Houwer, J., Denissen, J. J. A., Fiedler, K., … Wicherts, J. M. (2013). Recommendations for increasing replicability in psychology. *European Journal of Personality*, *27*(2), 108-119. https://doi.org/10.1002/per.1919

Axelrad, B. (2012). Quand le corps dit tout haut ce que l'esprit pense tout bas [When the body says loudly what the mind thinks down]. Retrieved from http://www.pseudo-sciences.org/spip.php?article1911

Blancke, S., Boudry, M., & Pigliucci, M. (2017). Why do irrational beliefs mimic science? The cultural evolution of pseudoscience. *Theoria*, *83*(1), 78-97. https://doi.org/10.1111/theo.12109

Bogaard, G., Meijer, E. H., Vrij, A., & Merckelbach, H. (2016). Strong, but wrong: Lay people's and police officers' beliefs about verbal and nonverbal cues to deception. *Plos One, 11*(6). http://doi.org/10.1371/journal.pone.0156615

Bond, C. F., & DePaulo, B. M. (2006). Accuracy of deception judgments. *Personality and Social Psychology Review*, *10*(3), 214-234. https://doi.org/10.1207/s15327957pspr1003_2

Bond, C. F., Levine, T. R., & Hartwig, M. (2015). New findings in non-verbal lie detection. In P.

A. Granhag, A. Vrij, & B. Vershuere (Eds.). *Detecting deception: Current challenges and cognitive approaches*. Chichester, UK: John Wiley & Sons. https://doi.org/10.1002/9781118510001.ch2

Broaders, S. C., & Goldin-Meadow, S. (2010). Truth is at hand: How gesture adds information during investigative interviews. *Psychological Science, 21*(5), 623-628. http://doi.org/10.1177/0956797610366082

Brodsky, S. L. (2013). *Testifying in court: Guidelines and maxims for the expert witness (2nd ed.).* Washington: American Psychological Association. https://doi.org/10.1037/14037-000

Brown, S. (2005). *Treating sex offenders: An introduction to sex offender treatment programmes*. Cullompton: Willan Publishing.

Burgoon, J. K., Guerrero, L. K., & Floyd, K. (2016), *Nonverbal communication*. New York: Routledge.

Byers, M., & Johnson, V. M. (2009). *The CSI effect: television, crime, and governance*. Plymouth: Lexington Books.

Colwell, L. H., Miller, H. A., Miller, R. S., & Lyons, P.M. (2006). US police officers' knowledge regarding behaviors indicative of deception: Implications for eradicating erroneous beliefs through training. *Psychology, Crime & Law, 12*(5), 489-503. https://doi.org/10.1080/10683160500254839

Damer, T. E. (2013). *Attacking faulty reasoning: A practical guide to fallacy-free arguments* (7th ed.). Boston: Cengage Learning

Denault, V. (2015). *Communication non verbale et crédibilité des témoins [Nonverbal communication and the credibility of witnesses]*. Cowansville: Yvon Blais.

Denault, V. (2018). *Developing critical thinking in a world of irrational beliefs. Autoethnographic perspectives from a former advocate of pseudoscience on transitioning to evidence-based academia.* Manuscript in preparation.

Denault, V., Plusquellec, P., Jupe, L. M., St-Yves, M., Dunbar, N. E., Hartwig, M., ... van Koppen, P. J. (in press). The analysis of nonverbal communication: The dangers of pseudoscience in security and justice contexts. *Anuario de Psicología Jurídica.*

Denault, V., & Jupe, L. M. (2017). Justice at risk! An evaluation of a pseudoscientific analysis of a witness' nonverbal behavior in the courtroom. *The Journal of Forensic Psychiatry & Psychology*, *126*(243), 1-22. https://doi.org/10.1080/14789949.2017.1358758

Denault, V., Larivée, S., Plouffe, D., & Plusquellec, P. (2015). La synergologie, une lecture pseudoscientifique du langage corporel. *Revue de psychoéducation*, *43*(2), 425-455. http://doi.org/10.7202/1039262ar

DePaulo, B. M., Lindsay, J. J., Malone, B. E., Muhlenbruck, L., Charlton, K., & Cooper, H. (2003). Cues to deception. *Psychological Bulletin, 129*(1), 2003, 74-118. http://doi.org/10.1037/0033-2909.129.1.74

Dodson, C. S., Powers, E., & Lytell, M. (2015). Aging, confidence, and misinformation: recalling information with the cognitive interview. *Psychology and Aging*, *30*(1), 46-61. https://doi.org/10.1037/a0038492

Ekman, P. (1992). *Telling lies: Clues to deceit in the marketplace, politics, and marriage*. New York: W. W. Norton and Company.

Elmore, S. A. (2017). Update on the manuscript peer review process. *Toxicologic Pathology*, *45*(8), 1028–1031. https://doi.org/10.1177/0192623317742616

European Institute of Synergology. (2015). Info synergo !!! [Online video]. Retrieved from https://www.facebook.com/InstitutEuropeenDeSynergologie/videos/598476310301856 (retrieved on July 28, 2017).

Federal Bureau of Investigation. (2018). High-Value Detainee Interrogation Group. Retrieved from https://www.fbi.gov/about/leadership-and-structure/national-security-branch/high-value-detainee-interrogation-group

Fisher, R. P., Geiselman, R. E., & Amador, M. (1989). Field test of the cognitive interview: Enhancing the recollection of actual victims and witnesses of crime. *Journal of Applied Psychology, 74*(5), 722-727. https://doi.org/10.1037/0021-9010.74.5.722

Fraigman, D. L. (2006). Judges as amateur scientists. *Boston University Law Review, 86*, 1207-1226.

Friendship, C., Mann, R. E., & Beech, A. R. (2003). Evaluation of a national prison-based treatment program for sex offenders in England and Wales. *Journal of interpersonal violence, 18*(7), 744-759. https://doi.org/10.1177/0886260503253236

Frosina, P., Logue, M., Book, A., Huizinga, T., Amos, S., & Stark, S. (2018). The effect of cognitive load on nonverbal behavior in the cognitive interview for suspects. *Personality and Individual Differences*, *130*(1), 51-58. https://doi.org/10.1016/j.paid.2018.03.012

Gagnon, C. (2018). "State of the art" agent: Threat detection. Retrieved from http://www.christinegagnon.ca/en/blog/state-of-the-art-agent-threat-detection

Geiselman, R. E., Fisher, R., MacKinnon, D. P., & Holland, H. L. (1986). Enhancement of eyewitness memory with the cognitive interview. *The American Journal of Psychology, 99*(3), 385-401. https://doi.org/10.2307/1422492

Greenwood, P. W., & Petersilia, J. R. (1975). *The criminal investigation process*. RAND

Corporation.

Hartwig, M., & Bond, C. F. (2011). Why do lie-catchers fail? A lens model meta-analysis of human lie judgments. *Psychological Bulletin*, *137*(4), 643-659.http://doi.org/643-659. 10.1037/a0023589

Heller, Á. (2017). Reflections on gullibility. *Telos*, *2017*(179), 36-47. https://doi.org/10.3817/0617179036

Hill, C., Memon, A., & McGeorge, P. (2008). The role of confirmation bias in suspect interviews: A systematic evaluation. *Legal and Criminological Psychology, 13*(2), 357-371. http://doi.org/10.1348/135532507X238682

Honts, C. R., Hartwig, M., Kleinman, S. M., & Meissner, C. A. (2009). Credibility assessment at portals: Portals committee report. Final Report of the Portals Committee to the Defense Academy for Credibility Assessment.

Horvath, F., Jayne, B., & Buckley, J. (1994). Differentiation of truthful and deceptive criminal suspects in Behavior Analysis Interviews. *Journal of Forensic Sciences*, *39*(3), 793-807. https://doi.org/10.1520/JFS13657J

Houck, M. M. (2006). CSI: Reality. *Scientific American*, *295*(1), 84-89. https://doi.org/10.1038/scientificamerican0706-84

Huisman, J., & Smits, J. (2017). Duration and quality of the peer review process: The author's perspective. *Scientometrics*, *113*(1), 633-650. https://doi.org/10.1007/s11192-017-2310-5

Inbau, F. E., Reid, J. E., Buckley, J. P., & Jayne, B. C. (2013). *Criminal interrogation and confessions*. Burlington: Jones & Bartlett Learning.

Jarry, J. (2016, May 21). *Vlog 10: Lie to me, synergology* [Online video]. Retrieved from https://www.youtube.com/watch?v=F2kvuLG_57c

Jarry, J. (2018, January 12). *Lies and nonverbal communication* [Online video]. Retrieved from https://www.youtube.com/watch?v=qIgwbE7XUC8

Jupe, L. M., Akehurst, L., Vernham, Z., & Allen, J. (2016). Teenage offenders' ability to detect deception in their peers. *Applied Cognitive Psychology*, *30*(3), 401-408. https://doi.org/10.1002/acp.3214

Kageleiry, P. J. (2007). Psychological police interrogation methods: Pseudoscience in the interrogation room obscures justice in the courtroom. *Military Law Review*, *193,* 1-51.

Knapp, M., Hall, J., & Horgan, T. (2014). *Nonverbal communication in human interaction*. Boston: Wadsworth.

Kozinski, A. (2015). Preface: Criminal law 2.0. *Georgetown Law Journal Annual Review Criminal Procedure, 44*, iii-xliv.

Lakatos, I. (1980). *The methodology of scientific research programmes*. Cambridge: Cambridge University Press.

Larivée, S. (2014). *Quand le paranormal manipule la science [When the paranormal manipulates the science]*. Montréal: Multimondes

Leone, C. (2015). U.S. v. Hodge: A case study in the use of the cognitive interview as a means to promote therapeutic jurisprudence in sexual assault cases under the Uniform Code of Military Justice (UCMJ). *The Air Force Law Review*, *74*, 201-228.

Levine, T. R., Serota, K. B., & Shulman, H. C. (2010). The impact of *Lie to Me* on viewers' actual ability to detect deception. *Communication Research*, *37*(6), 847-856. https://doi.org/10.1177/0093650210362686

Lilienfeld, S. O., & Landfield, K. (2008). Science and pseudoscience in law enforcement: A user-friendly primer. *Criminal Justice and Behavior*, *35*(10), 1215-1230.

https://doi.org/10.1177/0093854808321526

Lilienfeld, S. O., Lynn, S. J., & Lohr, J. M. (2014). *Science and pseudoscience in clinical psychology.* New York: Guilford Press.

Lindsay, D. S. (2015). Replication in Psychological Science. *Psychological Science*, *26*(12), 1827-1832. https://doi.org/10.1177/0956797615616374

Makgoba, M. W. (2002). Politics, the media and science in HIV/AIDS: The peril of pseudoscience. *Vaccine*, *20*(15), 1899-1904. https://doi.org/10.1016/S0264-410X(02)00063-4

Masip, J., Barba, A., & Herrero, C. (2012). Behaviour Analysis Interview and common sense: A study with novice and experienced officers. *Psychiatry, Psychology and Law*, *19*(1), 21-34. https://doi.org/10.1080/13218719.2010.543402

Memon, A., Meissner, C. A., & Fraser, J. (2010). The cognitive interview: A meta-analytic review and study space analysis of the past 25 years. *Psychology, Public Policy, and Law*, *16*(4), 340–372. https://doi.org/10.1037/a0020518

Moody, M. (2014). Nonverbal Communication Expert to Keynote ACFE Canadian Fraud Conference. Retrieved from https://acfeinsights.squarespace.com/acfe-insights/2014/8/5/hg49z60sjilsch75gdhcqjvlmaki32

Moore, N.-J., Hickson, M., & Stacks, D. W. (2014). *Nonverbal communication: Studies and applications*. Oxford: Oxford University Press.

Moreno, J. A. (2003). Einstein on the bench: Exposing what judges do not know about science and using child abuse cases to improve how courts evaluate scientific evidence. *Ohio State Law Journal, 64*, 351-584.

Nahari, G. (2018). The applicability of the Verifiability Approach to the real world. In J. P.

Rosenfeld (Ed.), *Detecting concealed information and deception: Recent developments.* London: Academic Press.

Nickerson, R. S. (1998). *Confirmation bias: A ubiquitous phenomenon in many guises*. *Review of General Psychology, 2*(2), 175-220. https://dx.doi.org/10.1037/1089-2680.2.2.175

Open Science Collaboration (2012). An open, large-scale, collaborative effort to estimate the reproducibility of psychological science. *Perspectives on Psychological Science*, *7*(6), 657-660. https://doi.org/10.1177/1745691612462588

Otgaar, H., & Howe, M. (2017). *Finding the truth in the courtroom: Dealing with deception, lies, and memories*. New York: Oxford University Press.

Pigliucci, M., & Boudry, M. (2013a). Philosophy of pseudoscience: Reconsidering the demarcation problem. Chicago: The University of Chicago Press.

Pigliucci, M., & Boudry, M. (2013b). The dangers of pseudoscience. Retrieved from https://opinionator.blogs.nytimes.com/2013/10/10/the-dangers-of-pseudoscience

Popper, K. (1968). *The logic of scientific discovery.* New York: Harper.

Porter, S., & ten Brinke, L. (2008). Reading between the lies: Identifying concealed and falsified emotions in universal facial expressions. *Psychological Science, 19*(15), 508-514. https://doi.org/10.1111/j.1467-9280.2008.02116.x

Porter, S., & ten Brinke, L. (2009). Dangerous decisions: A theoretical framework for understanding how judges assess credibility in the courtroom. *Legal and Criminological Psychology, 14*(1), 119-134. https://doi.org/10.1348/135532508X281520

Porter, S., ten Brinke, L., & Gustaw, C. (2010). Dangerous decisions: The impact of first impressions of trustworthiness on the evaluation of legal evidence and defendant

culpability. *Psychology Crime & Law, 16*, 477-491. https://doi.org/10.1080/10683160902926141

Quebec Association of Synergology (n.d.). En quoi la synergologie est-elle une discipline scientifique [How synergology is a scientific discipline]. Retrieved from http://www.monaqs.ca/la-discipline

R. v. Handy, [2002] 2 SCR 908, 2002 SCC 56 (CanLII).

Redding, R. E., Floyd, M. Y., & Hawk, G. L. (2001). What judges and lawyers think about the testimony of mental health experts: A survey of the courts and bar. *Behavioral Science and the Law, 19*(4), 583–594. https://doi.org/10.1002/bsl.455

Robles, M. M. (2012). Executive perceptions of the top 10 soft skills needed in today's workplace. *Business and Professional Communication Quarterly*, *75*(4), 453–465. https://doi.org/10.1177/1080569912460400

Sackett, D. L., Rosenberg, W. M., Gray, J. A., Haynes, R. B., & Richardson, W. S. (1996). Evidence based medicine: What it is and what it isn't. *BMJ*, *312*(7023), 71-72. https://doi.org/10.1136/BMJ.312.7023.71

Sagan, C. (1979). *Broca's brain: Reflections on the romance of science*. New York: Presidio Press.

Schweitzer, N. J., & Saks, M. J. (2007). The CSI Effect: Popular fiction about forensic science affects the public's expectations about real forensic science. *Jurimetrics*, 47(3), 357-364. https://doi.org/10.2307/29762978

Serin, R. C., Gobeil, R., & Preston, D. L. (2009). Evaluation of the persistently violent offender treatment program. *International Journal of Offender Therapy and Comparative Criminology*, *53*(1), 57-73. https://doi.org/10.1177/0306624X07313985

Shallit, J. (2005). Science, pseudoscience, and the three stages of truth. Retrieved from https://cs.uwaterloo.ca/~shallit/Papers/stages.pdf

Shermer, M. (2002). *Why people believe in weird things.* New York: Henry Holt and Company.

Shermer, M. (2013). Science and pseudoscience: The difference in practice and the difference it makes. In M. Pigliucci & M. Boudry (Eds.), *Philosophy of pseudoscience*. Chicago: The University of Chicago Press. https://doi.org/10.7208/chicago/9780226051826.001.0001

Shipman, M. (2014). *The limitations of social research*. London: Routledge.

Sooniste, T., Granhag, P. A., Strömwall, L. A., & Vrij, A. (2015). Statements about true and false intentions: Using the Cognitive Interview to magnify the differences. *Scandinavian Journal of Psychology*, *56*(4), 371-378. https://doi.org/10.1111/sjop.12216

Spier, R. (2002). The history of the peer-review process. *Trends in Biotechnology*, *20*(8), 357-358. https://doi.org/10.1016/S0167-7799(02)01985-6

Synergology, The Official Website (n.d.a). Synergologie, une discipline scientifique de lecture du langage corporel [Synergology, a scientific discipline to read body language]. Retrieved from http://non-verbal.synergologie.org/nonverbal/communication-non-verbale/le-langage-corporel-doit-il-etre-un-objet-scientifique

Synergology, The Official Website (n.d.b). Etudier la discipline Synergologie pour comprendre le non-verbal [Study the discipline Synergology to understand non-verbal]. Retrieved from http://formation.synergologie.org/

Tadei, A., Finnilä, K., Reite, A., Antfolk, J., & Santtila, P. (2016). Judges' capacity to evaluate psychological and psychiatric expert testimony. *Nordic Psychology, 68*, 204-217. https://doi.org/10.1080/19012276.2015.1125303

ten Brinke, L., Stimson, D., & Carney, D. R. (2014). Some evidence for unconscious lie

detection. *Psychological Science*, *25*(5), 1098-1105. https://doi.org/10.1177/0956797614524421

The Global Deception Research Team. (2006). A world of lies. *Journal of Cross-Cultural Psychology, 37*(1), 60-74. http://doi.org/10.1177/0022022105282295

Turchet, P. (2012). The secrets of body language: An illustrated guide to knowing what people are really thinking and feeling. New York: Skyhorse Publishing.

Vrij, A. (2008). *Detecting lies and deceit: Pitfalls and opportunities*. Chichester: John Wiley & Sons.

Vrij, A., & Granhag, P. A. (2012). Eliciting cues to deception and truth: What matters are the questions asked. *Journal of Applied Research in Memory and Cognition*, *1*(2), 110-117. https://doi.org/10.1016/j.jarmac.2012.02.004

Vrij, A., Hope, L., & Fisher, R. P. (2014). Eliciting reliable information in investigative interviews. *Policy Insights from the Behavioral and Brain Sciences*, *1*(1), 129-136. https://doi.org/10.1177/2372732214548592

Vrij, A., Mann, S., & Fisher, R. P. (2006). An empirical test of the Behaviour Analysis Interview. *Law and Human Behavior*, *30*(3), 329-345. https://doi.org/10.1007/s10979-006-9014-3

Vrij, A., Meissner, C. A., Fisher, R. P., Kassin, S. M., Morgan III, C. A., & Kleinman, S. M. (2017). Psychological perspective on interrogation. *Perspectives on Psychological Science*, *12*(6), 927-955. http://doi.org/10.1177/1745691617706515

Walton, D. N. (1987). The ad hominem argument as an informal fallacy. *Argumentation*, *1*(3), 317-331. https://doi.org/10.1007/BF00136781

Ware, M. (2008). *Peer review: benefits, perceptions and alternatives*. London: Publishing

Research Consortium.

White, E. (2014). Science, pseudoscience, and the frontline practitioner: The vaccination/autism debate. *Journal of Evidence-Based Social Work*, *11*(3), 269-274. https://doi.org/10.1080/15433714.2012.759470