SCANning for truth. Scholars' and practitioners' perceptions on the use(fulness) of Scientific Content Analysis in detecting deception during police interviews

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Abstract

SCAN (Scientific Content Analysis) is a verbal credibility assessment (VCA) tool that claims to detect deception in written statements. Although the validity of SCAN is contested in literature, various (law enforcement) agencies across the globe are trained in using SCAN. To date it remains unknown how SCAN is perceived, and to what extent it is used in practice. Based on a scoping review and qualitative survey, we identified practitioners' and scholars' perceptions on the use(fulness) of SCAN. Data were collected from 48 participants (35 practitioners and 13 scholars). Key findings illuminate that (1) practitioners apply an incomplete, personalised version of SCAN, (2) that SCAN practitioners are reluctant to abandon SCAN, and (3) that SCAN is considered incompatible with (Belgian) legislation on police questioning. Based on practitioners' expressed needs and concerns, we present several alternatives for SCAN, as well as recommendations on how a shift to other techniques can be facilitated.

Keywords: Credibility assessment, deception detection, lie detection, investigative interviewing, interrogation

Word count: 11.118

Introduction

Investigative interviewing is an essential part of police work. Investigative interviewers spend up to 80% of their time in the interview room during a judicial investigation (De Greef & De Fruyt, 2006). Obtaining truthful information about the offence and involvement of suspects is an important goal of investigative interviews (Gudjonsson & Pearse, 2011). Based on the assumption that verbal structures of true and false statements significantly differ from each other, verbal credibility assessment (VCA) tools can assist investigative interviewers in detecting lies and/or deception (Meijer et al., 2008; Nicklaus & Stein, 2020; Vrij, 2008). In particular, VCA methods test verbal indicators of statements based on the tool's specific criteria. The presence or absence of certain criteria is considered as an indication of either truthful or misleading/deceitful information (Bogaard et al., 2019; Bogaard et al., 2016a). Examples of VCA tools include amongst others: Verifiability Approach (VA), Statement Validity Analysis (SVA), Criteria Based Content Analysis (CBCA), Reality Monitoring (RM)[1], and Scientific Content Analysis (SCAN) (Bogaard, 2017; Bogaard et al., 2014a; Bogaard et al., 2014b; Bogaard et al., 2016a; Meijer et al., 2008; Smith & Willis, 2001; Vrij et al., 2022). In this article, we focus on SCAN.[2]

SCAN was developed by former polygraph examiner Avinoam Sapir (LSI, n.d.) and claims to detect misleading and hidden information, as well as involvement in a crime by analysing a written statement (Vanderhallen et al., 2016). SCAN thus represents itself as a technique to detect deception (Armistead, 2011; Kang & Lee, 2014; Smith & Willis, 2001; Vanderhallen et al., 2016), not as a lie detection tool.[3] When applying SCAN, practitioners follow six steps (Bockstaele, 2019). First, the 'initial phase' serves as an introduction between the interviewer and interviewee in order to minimize resistance of the interviewee (Bockstaele, 2019). Second, in order to obtain a 'pure version statement', the interviewee is asked to write everything down about a certain event without any guidance or influence (Bogaard, 2017; Bogaard et al., 2014a; Bogaard et al., 2014b; Bogaard et al., 2016a; Meijer et al., 2008; Smith & Willis, 2001; Vanderhallen et al., 2016; Bockstaele, 2019). Third, this written statement is analysed using SCAN criteria (Bogaard, 2017; Bogaard et al., 2016a; Meijer et al., 2008; Bockstaele, 2019) in order to detect 'highlights' or 'hotspots' that indicate deception. Table 1 represents SCAN's criteria following Belgian police superintendent Bockstaele (2019). Fourth, these hotspots are discussed more thoroughly in subsequent interviews (Bockstaele, 2019; Bogaard, 2017; Smith & Willis, 2001). Fifth, as part of the detailed interview, the interviewer asks open questions and aims to build rapport, for example by using the word 'we' and smiling at the interviewee. Sixth, debriefing after the detailed interview allows the interviewer to probe for the interviewee's experienced emotions during the interview (Bockstaele, 2019).

[1] For a more detailed explanation of these techniques, see Vrij et al. (2022) and Oberlader et al. (2020).
[2] The following overview of the literature was obtained through a scoping review, of which the research protocol can be found in Appendix 1.
[3] Deception and lying are often used as synonyms, but when considering SCAN the distinction between both is often emphasized. According to Vrij (2008, p. 15) deception can be defined as "*a successful or unsuccessful deliberate attempt, without forewarning, to create in another a belief which the communicator considers to be untrue*". As such, there is a clear intent to conceal/withhold information and to mislead the receiver of the information, whereas lying can be considered as intentionally providing a false statement, of which the receiver might either be (un)aware that a lie is being told (for a detailed analysis, see Vrij (2008)). In this regard, lying can be considered as being a specific form of deception.

[Insert Table 1 here]

Extant research consistently dissuades the further use of SCAN for several reasons. Most importantly, SCAN criteria differ from study to study (Meijer et al., 2008; Oberlader et al., 2020). Besides the unclear content of these criteria, the number of criteria to be used ranges from ten to sixteen in different studies (see Bockstaele, 2019; Bogaard et al., 2014a; Bogaard et al., 2014b; Bogaard et al., 2014c; Kang & Lee, 2014; Smith & Willis, 2001). Because of this discrepancy in interpretation and number of criteria, analysts apply SCAN differently and obtain different results after analysing the same statement. As a consequence, SCAN is found to have low (interrater) reliability (Bogaard, 2017; Bogaard et al., 2014a; Bogaard et al., 2014b; Bogaard et al., 2014c; Kang & Lee, 2014; Kleinberg et al., 2019; Smith & Willis, 2001; Vanderhallen et al., 2016), caused by the lack of well-defined criteria and personal interpretations of the analysts (Bogaard et al., 2014a; Bogaard et al., 2014b; Bogaard et al., 2016b; Meijer et al., 2008; Vanderhallen et al., 2016). Furthermore, the technique has only a limited ability to differentiate between truthful and dubious or fabricated statements, making the validity of SCAN questionable (Bogaard, 2017; Bogaard et al., 2014a; Bogaard et al., 2014b; Bogaard et al., 2014c; Kleinberg et al., 2019; Vanderhallen et al., 2016). What is more, SCAN does not contain a criterion that allows to distinguish between true and false statements (Bogaard, 2017; Bogaard et al., 2014a; Bogaard et al., 2016a), and would hence fail to detect the truth (Bogaard, 2017; Nahari et al., 2011; Vanderhallen et al., 2016). Moreover, SCAN tends to increase the risk of tunnel vision and judicial errors (Komel et al., 2020; Vanderhallen et al., 2016). In addition, when compared to the academically well-established VCA tool 'Criteria Based Content Analysis' (CBCA), SCAN includes the criteria 'lack of memory of the event', 'spontaneous corrections', and 'extraneous information' as indicators of deception, whereas CBCA considers these criteria as truthful (Bogaard, 2017; Bogaard et al., 2014b; Oberlader et al., 2020).

In sum, despite SCAN being represented as *'the key to unlocking the truth*' (LSI, n.d.), there is very little academic substantiation for its use (Armistead, 2011; Bogaard, 2017; Bogaard et al., 2014c; Meijer et al., 2008; Oberlader et al., 2020; Vrij & Nahari, 2017). SCAN is based on nearly no empirical evidence and thus poses a risk to use in practice (Heydon, 2008; Oberlader et al., 2020). Nevertheless, a wide range of practitioners including police forces, intelligence services, and private actors, in a number of countries apply SCAN in their daily practice (Bogaard, 2017; Bogaard et al., 2014a; Bogaard et al., 2014b; Bogaard et al., 2014c; Bogaard et al., 2016a; Bogaard et al., 2016b; Meijer et al., 2008; Smith & Willis, 2001). But to date, practitioners have been left out of research. Extant research – most of which has experimental designs with students as participants – has not taken into account the use and perceptions of SCAN practitioners. Consequently, it remains unknown how practitioners use SCAN (being trained does not equate implementation in practice), and why they continue to use a controversial technique that lacks empirical support. Therefore, it is critical to understand how and why SCAN is used by practitioners. In this study, we fill this gap by evaluating the use of SCAN among practitioners who attended a SCAN training in Belgium between 2012 and 2018, as well as their attitudes toward the usefulness and validity of SCAN. Based on those arguments, we also identify some important needs and concerns of practitioners that may prevent them from making the shift toward other VCA techniques, even though extant academic research clearly states that SCAN fails in terms of reliability, validity,

standardization, and purpose. This study contributes to this existing literature by examining SCAN's use and applicability in practice, which has not been done until today. If it appeared that SCAN is being trained but not used in practice, existing and further research on SCAN would only be of theoretical value. This study furthermore offers the possibility to examine whether academia's call to forget SCAN for good is heard by practitioners. The results of this study also provide the first insight into the needs and concerns of practitioners on VCA techniques. This offers unique avenues for future research and training. Moreover, because SCAN is used by practitioners despite the negative advice from academics, there seems to be a strong discrepancy between both groups. By way of comparison and to confirm or refute the possible discrepancy between practitioners and academics, we also examine academics' attitudes toward the usefulness and validity of SCAN. These academics include: (1) academic experts specialized in SCAN worldwide, and (2) academic experts with affinity[4] in Belgium or the Netherlands specialized in investigative interviewing, or VCA techniques.

The following research questions are answered by an online qualitative questionnaire with open- and closed-ended questions:

(1) To what extent do practitioners trained in using SCAN in Belgium between 2012 and 2018 use the technique in practice?
(2) What are the prevailing attitudes toward SCAN (and its future use) among practitioners trained in using SCAN in Belgium between 2012 and 2018?
(3) What are the prevailing attitudes toward SCAN (and its future use) among: (a) academic experts specialized in SCAN worldwide and (b) academic experts with affinity in Belgium or the Netherlands specialized in investigative interviewing, or VCA techniques?
(4) What are the needs and concerns of practitioners trained in using SCAN in Belgium between 2012 and 2018 with regard to VCA techniques?

Materials and methods

Participants and procedure

Practitioners completed a practice-oriented version of the questionnaire (see Appendix 2), whereas academics completed an academic version of the questionnaire (see Appendix 3). Practitioners were recruited by attendance lists from previous SCAN trainings organised by the Belgian *Centre for Policing and Security* (CPS).[5] CPS organises a yearly three day basic SCAN training, followed by a two day more in-depth specialized training. SCAN's founder Avinoam Sapir teaches both courses. All 103 Dutch-speaking participants from 2012 to 2018 of the basic and specialized SCAN trainings were invited to participate in the study (N = 103). Due to the extensive legislative changes in Belgium in 2012 with regard to police questioning following the EU Directive 2013/28/EU and the European Court of Human Rights case law (such as the case of Salduz v. Turkey; in this study referred to as 'Salduz legislation')

[4] 'Affinity' refers to a connection with Belgium or the Netherlands through work and/or research (collaboration(s)).
[5] This research was conducted in collaboration with CPS (https://www.policingandsecurity.be/). To our knowledge, CPS is the only organisation that offers SCAN training in Belgium.

on access to a lawyer prior to and during police questioning[6], we only included practitioners who followed SCAN training after 2012. We did this to make sure that respondents followed training and operate in the current legal context. The questionnaire was filled out by 44 practitioners, of which 9 participants only answered the first couple questions. A sample of 35 practitioners filled out the entire questionnaire, implying a 34% response rate. We thus surveyed 34% of the population.

We used a non-random homogeneous purposive sampling method (Sharma, 2017) to select academics, based on two inclusion criteria: (1) active in the field of criminology and/or legal psychology, and (2) at least one published article as first author on investigative interviewing, VCA techniques, or specifically SCAN. With regard to investigative interviewing and VCA techniques, only academics with affinity in Belgium or the Netherlands were included. Otherwise the sample of academics would be too large given the time and means of the study. With regard to SCAN, all academics worldwide (meaning Belgium, the Netherlands, and other countries) were included, due to the small amount of academics that are specialized in SCAN. A search with these inclusion criteria resulted in a list of 39 academics. No additional academics were found and saturation was reached. Contact details were available for 35 out of 39 identified academics. The questionnaire was eventually filled out by 13 academics[7], implying a 37% response rate[8]. The majority of our sample (9/13) had affinity with Belgium or the Netherlands and its legal systems. With 35 practitioners and 13 academics, the full sample thus included 48 respondents.

[Insert Table 2 here]

Participants were contacted directly by a personal email and did not receive an email reminder, due to lack of time. To mitigate the risk of non-response, participants were addressed personally and an indication of time to complete the questionnaire was given (McPeake et al., 2014). As depicted in Table 2, slightly more than half of the sample was male. The large majority of practitioners worked at police forces. Most practitioners were very satisfied with the SCAN training they attended and the large majority followed the specialized SCAN training at CPS. A small proportion of academics followed training in SCAN. The demographics of our practitioners sample were similar to the demographics of the population (practitioners trained in using SCAN in Belgium between 2012 and 2018). According to population demographics, 54,21% of practitioners trained in using SCAN in Belgium between 2012 and 2018 was male and 42,06% was female. 54,21% of the population worked at police forces, whereas 14,02%

[6] For a more detailed explanation of the Belgian legislation in this regard, see Mergaerts & Dehaghani (2020). Suspects are entitled to consult with a lawyer prior to police questioning and are allowed to be assisted by a lawyer during police questioning as well (Article 47*bis* Belgian Code of Criminal Procedure and Article 2*bis* Belgian Pre-trial detention Act).

[7] Seven academics identified as complete experts on SCAN, fully aware of SCAN's literature, content, and method. Four academics identified as semi experts on SCAN, fully aware of SCAN's literature, or SCAN's content and method. Only two academics indicated they have notions of SCAN, as such they are familiar with SCAN but are no experts. The number of experts thus consists of eleven academics.

[8] The demographics of the academic population are not known. We surveyed academics as a way of comparison. We therefore used a non-random homogeneous purposive sampling method based on two inclusion criteria to select academics and stopped when saturation was reached. It was thus not our intention to collect a representative sample of academics.

worked in the judicial system, 19,63% worked in the private sector, and 5,61% worked at inspection services. Our sample of practitioners is thus representative for the population.

Questionnaire

The practice- and academics-oriented questionnaire took each approximately 20 minutes to complete. Before distributing, a draft of the questionnaire was reviewed by police, private practitioners, and academics.[9] Respondents received a personal introduction mail containing information about the study, sampling method, and guarantees of confidentiality and anonymity. Before starting the questionnaire, a box regarding informed consent had to be ticked off, stressing guarantees concerning voluntary participation, the right to withdraw, anonymous reporting of the results, and the possibility to contact the researcher. The online questionnaire was designed using ThesisTools and consisted of open- and closed-ended questions. Follow-up questions and probing (Bell et al., 2016) were anticipated as much as possible. Each open question was followed by one or more follow-up question(s) to stimulate further explanation of participants' answers. Given the majority of open-ended questions, several closed-ended questions, anticipation of follow-up, and online standardized character of the survey with prespecified questions and order, this study followed an open-ended standardized approach. This implied a qualitative nature with several quantitative elements (Halcomb & Davidson, 2006).

The practice-oriented questionnaire (see Appendix 2) focused on three sections: SCAN training; use; perception and future perspectives. Multiple choice answers regarding the use of SCAN criteria were based on the work of Belgian police superintendent Bockstaele (2019) as this work possesses the most extensive list of criteria. The academics-oriented questionnaire (see Appendix 3) included three sections: SCAN training; academic research; perception and future perspectives. The sections in the practice- and academics-oriented questionnaire consisted of open questions, as well as closed questions and propositions with a Likert-scale response format. Data were automatically transcribed to Excel by ThesisTools. Open-ended questions were coded by the process of open, axial, and selective coding. Open coding involved the development of a code tree, whereas axial coding organised these codes according to (sub)themes, and selective coding focused on the in-depth analysis of data in search for similarities and differences (Decorte & Zaitch, 2016; Williams & Moser, 2019). With regard to the closed-ended questions with designated response options, descriptive univariate statistics were used. The results described below focus on the use, perception, and future perspectives of SCAN.

Results

Use

As depicted in Table 3, SCAN is used by the majority of practitioners who followed SCAN training in Belgium (65,7%). Of this 65,7%, only a small proportion applies the technique in the majority of interviews (17,4%). When asked why SCAN is not used in most interviews, respondents refer to

[9] The questionnaires were reviewed by the supervisors of the project and external experts, both from practice and academia. These reviewers were also contacted to fill out the questionnaires. Whether or not those reviewers filled out the questionnaires is not known due to anonymity.

complexity and loss of knowledge over time. When asked about the reasons why participants do not use SCAN, practitioners indicate the impossibility to obtain a written statement and the lack of support amongst judicial authorities and academics, as well as the lack of clarity on how SCAN should be applied. As explained in the introduction, SCAN's 'pure version statement' should be obtained without any guidance or influence from police officers or defence lawyers prior or during police questioning. To overcome the difficulty of obtaining this 'pure version statement' based on free recall, some respondents indicate they use SCAN verbally during police questioning. They thus apply the criteria to what the interviewee says, not to what he or she writes. Some users stress that SCAN should be incorporated into a global interviewing strategy and should be used complementary to other interview techniques. The vast majority of academics (77%) dissuades the use of SCAN in practice, based on the absence of academic support, as already mentioned in the scoping review. They indicate that other techniques should be used instead. Only two academics state that SCAN can be applied cautiously, to acquire additional information from an interviewee.

[Insert Table 3 here]

Only five SCAN users (21,7%) indicate that they use all SCAN criteria. The majority (69,6%) only applies a selection of SCAN criteria. The criteria 'details within statement', 'evasive answers', 'spontaneous denials/corrections', 'not answering the question', and 'language changes' are most commonly used. Practitioners refer to these criteria as the criteria that can be applied verbally and do not require a written text. As such, while applying these 'verbal criteria' they also take into account sensory or non-verbal communication, which is not included in a 'standard' SCAN analysis, *i.e.*, how SCAN is intended to be applied. 'Placing of emotions within the statement' is less commonly used. When asked why not all criteria are utilized, a number of respondents state that it is too labour-intensive and time consuming to apply all criteria, as well as that some criteria, like 'improper use of pronouns' and 'lack of social introduction', are unreliable as deception indicators. Some practitioners consider SCAN too difficult to implement in practice, referring to too many criteria that need to be checked when conducting a full SCAN analysis. Consequently, no SCAN user follows all predefined phases. Most respondents use the steps 'analysis, 'detailed interview', and 'pure version statement'. Users indicate they apply SCAN to suspects, witnesses, and victims. One respondent who works in insurances indicates he uses SCAN on customers. The police officers whom participated in this study use SCAN in interviews involving sex offences, thefts, violence, drugs, fraud, embezzlement, and manslaughter. Other participants use SCAN in interviews where certain elements are written down spontaneously such as farewell letters, when the person involved refuses to make a statement, or to make a selection of a large number of suspects.

Most practitioners (75,9%) are not familiar with other VCA tools such as SVA, CBCA, or RM. Of the few practitioners who state to be familiar with other VCA techniques, only one actually applies these. Five respondents (14,3%) indicate they prefer SCAN, since SVA, CBCA, and RM should be applied by either a psychiatrist or psychologist, whereas SCAN is the only technique to be applied by police independently. The majority of academics (69,2%) calls for a replacement of SCAN by other interviewing

techniques such as VA, CBCA, RM, Strategic Use of Evidence (SUE), Cognitive Credibility Assessment (CCA), or Assessment Criteria Indicative of Deception (ACID)[10].

Perception and future perspectives

As seen in Table 4, the overall majority of academics (77%) states that SCAN does not offer an added value during investigations, whereas the majority of practitioners (75,9%) acknowledges the added value of SCAN. With regard to positive aspects of SCAN, practitioners refer to the practical applicability and ability to use SCAN without other techniques. Moreover, they state SCAN provides a different perspective on the statement and allows the interviewer to gather more insight into the written text. The majority of practitioners (72,4%) agrees with the proposition that SCAN contributes to keeping the investigative directions broad and reduces the risk of tunnel vision. One academic states SCAN can contribute to *'ringing alarm bells'*, but should be always weighed up against other information available in a case. Looking into the added value of SCAN during police interviews, some SCAN users argue that the technique allows the interviewer to look at the case differently and dig deeper into certain topics. One respondent mentions the reopening of a case because of SCAN and the discovery of a false statement provided by a victim of sexual violence. On the contrary, one participant refers to a false confession obtained from a suspect with low intelligence as a consequence of using SCAN.

[Insert Table 4 here]

One out of three practitioners (34,29%) indicate that they cannot identify negative aspects of SCAN. The majority argues that SCAN is time consuming and complex. Furthermore, practitioners state that SCAN does not fit into the usual practice of police questioning as written statements are seldomly obtained. Practitioners also indicate that SCAN is not compatible with current Belgian legislation on police questioning (such as the Salduz legislation). It should be noted that participants stress that defence lawyers tend to perceive SCAN as unreliable and oftentimes object to using SCAN. As a consequence, suspects are advised not to write a 'pure version statement'. SCAN's initial phase with preliminary questioning is also considered difficult given the current legal context and presence of a lawyer. What is more, some practitioners indicate that SCAN does not take into account language barriers or the incapacity of some suspects to write a statement. Furthermore, respondents continuously refer to the lack of academic underpinning. Only a small proportion of practitioners (24,1%) claims to be fully abreast of SCAN's academic research. According to one academic, SCAN is just a *'jumble'* of items from other methods with no standardization, no interrater reliability, and an increased risk of confirmation bias. One academic illustrates that compared to SCAN, '*tossing a coin seems to work just as well to detect lies and deception'.* The vast majority of academics urges not to use SCAN in practice *'the sooner, the better'* and to apply other techniques such as CBCA and RM.

Considering the future perspectives on SCAN, the majority of practitioners (86,2%) is rather optimistic. A large proportion of practitioners already using SCAN (82,6%) claims they intend to continue using this technique if possible. Some state they will use SCAN complementary to other methods. One respondent

[10] For a more detailed explanation of these techniques, see Vrij et al. (2022) and Oberlader et al. (2020).

specifically mentions that other colleagues will analyse the statement as well to counterbalance the low interrater reliability and the risk of tunnel vision. Other practitioners (13,8%) are not willing to apply SCAN in the future. Contrary to most practitioners, the majority of academics encourages to ban the use of SCAN, with one academic stating that SCAN *'hopefully disappears as soon as possible'*. According to the majority of academics, an integration of SCAN with other VCA techniques is not desirable. One academic explicitly urges for a *'cross-fertilization'* between practitioners and academics as this would be in the best interest of both, whether or not for a thorough reform of SCAN.

To overcome current shortcomings on SCAN, practitioners present the following guidelines and needs for future techniques. The vast majority of practitioners calls for an academically underpinned technique to investigate truthfulness verbally in different settings or circumstances, taking into account the current Salduz legislation. Practitioners also state that such technique(s) should be easily applicable in practice. They want a technique that is time efficient and can be applied by practitioners independently, without the assistance of other experts, such as psychologists. Practitioners furthermore prefer sufficient and periodic training to remain up to date on the state of the art of existing or new techniques. Some practitioners furthermore refer to the added value of artificial intelligence (AI), that allows to automatically transcribe and analyse statements obtained during police questioning. Such AI programmes would make investigative interviewing and VCA techniques more efficient and less time consuming according to practitioners.

Discussion

Main findings

SCAN is an analytic method used by various practitioners across the globe that aims to detect deception in written statements. A full SCAN analysis consists of six phases and presumably sixteen criteria to apply to the written text. Academic research has demonstrated some fundamental problems associated with SCAN. These problems include, amongst others, SCAN's ambiguity of the number and content of criteria, low (interrater) reliability, contradictions with the academically established CBCA, and low validity. The literature is clear about SCAN: SCAN fails to detect deception.

Nevertheless, a wide range of practitioners apply SCAN on a daily basis. To date, these practitioners' experiences and views have largely been overlooked in SCAN research. Consequently, it remained unknown to what extent law enforcement practitioners (do not) use SCAN in practice and why they tend to do so. This study addressed this knowledge gap by qualitatively surveying both practitioners and academics on SCAN. In doing so, we provided a unique insight in the use of SCAN by practitioners who received SCAN training in Belgium between 2012 and 2018, as well as their attitudes toward the use(fulness) and validity of SCAN. Based on their arguments for (not) using SCAN, we also identified some important needs and concerns of practitioners to be taken into account when aiming to facilitate a shift toward other VCA techniques. As a way of comparison, this study also gained insight into academics' attitudes on the usefulness and validity of SCAN. This comparison demonstrates a clear disconnection between practitioners and academic research and provides for important recommendations to be taken into account when developing new research ideas on VCA techniques.

Our results add to the existing literature in several important ways. Our results demonstrate that SCAN is used by the majority of practitioners who followed SCAN training in Belgium (65,7%). SCAN is used on suspects, witnesses, and victims in different types of interviews. Nevertheless, it is applied in a limited and slimmed-down form. In particular, the vast majority utilizes a personal selection of SCAN criteria and no SCAN user follows all six phases, mainly because of the complexity, lack of consensus, and difficulty to obtain a written statement. SCAN is thus not used as how it was developed to be used. In short, apart from the fundamental academic concerns on SCAN, this study uncovers an even bigger problem, *i.e.* an impartial and unintended application of SCAN criteria. This impartial application varies among practitioners, depending on what is considered useful/relevant when conducting police interviews in the absence of written statements. This finding complements with the lack of clarity on the number and interpretation of SCAN criteria as mentioned in the scoping review. As such, SCAN's applicability in practice staggers. This applied 'personalised version' further weakens the already low interrater reliability of SCAN. Such downsizing and customization is not desirable, since extant research already states that SCAN in its full format does not work.

The results also clearly reflect a discrepancy between practitioners and academics, as found in the scoping review. The overall majority of academics consistently dissuades the (further) use of SCAN, while the majority of SCAN users is rather optimistic about the (further) use of the technique. We advise practitioners to abandon SCAN altogether. Practitioners should no longer use SCAN, but should adopt other techniques instead. SCAN's major weakness is its inability to detect deception. Another important shortcoming emerging from our results is its incompatibility with Belgian legislation on police questioning (*e.g.*, the difficulty to obtain a written statement). Since the large majority of our practitioners worked at police forces (57,1%), the results of this study mostly apply to police practitioners who followed SCAN training in Belgium. As such, SCAN should definitely be abandoned in Belgian police practice. Nevertheless, the results of the current study are also relevant for other practitioners (deliberating to) using SCAN, in- and outside of Belgium. This is particularly the case given that access to a defence lawyer prior to and during police questioning has been introduced in different European countries over the past few years following EU legislation and case law of the European Court of Human Rights, such as the Salduz legislation (cf. supra) (Cape & Hodgson, 2014; Giannoulopoulos, 2016).

Furthermore, based on SCAN's scathing academic research, the conclusion on the use of SCAN is obvious: SCAN should not be used in criminal proceedings. Our results, however, clearly demonstrate that SCAN is still used and that practitioners adopting SCAN are reluctant to abandon this technique, mainly because of SCAN's practical applicability and believed ability to gather more insight into statements. This finding demonstrates that the current body of knowledge on SCAN – and its alternatives – does not find its way into practice. Eager for practice-oriented tools to assess truth or deception in interviews, practitioners have turned to a commercial tool as SCAN instead of academia (Nahari et al., 2019). The current unequivocal academic conclusions on SCAN not finding their way into practice is thus a reason for concern. Academics urge for a shift toward other VCA techniques, whereas our results indicate that the majority of practitioners lacks (basic) knowledge on academically underpinned investigative interviewing practices and VCA tools. Nevertheless, practitioners indicate they need and want to be trained in other techniques than SCAN. With regard to those other techniques,

this study highlights important practitioners' needs and concerns to be taken into account when amending existing techniques and developing new techniques or training programmes. By analysing why and how practitioners (do not) use the academically unsound SCAN, this study provides clear insight into such a practical technique's requirements and offers future avenues for research. Practitioners require a technique that: (1) can be used verbally in real-time in everyday police questioning and different settings/circumstances, (2) takes into account verbal and non-verbal indicators, (3) can be used independently in practice and is easily applicable in practice, (4) fits within the current legal context and takes into account the access and presence of defence lawyers prior and during police questioning (e.g., Salduz legislation), (5) is time efficient (for example through AI), and (6) is accompanied by sufficient and periodic training opportunities to remain up to date on existing or new techniques.

Limitations

Several limitations of this study are important to note. First, we used a strict selection of academics (see our motivation for this in 'participants and procedure', 2nd paragraph). A less strict inclusion of academics would have generated more respondents. A larger sample of academics could have provided additional insights on other VCA techniques. Second, due to the online nature of our survey, it was not possible to obtain the same in-depth information as in face to face interviews, even though probing was incorporated into the survey as much as possible. As a consequence, other in-depth information on respondents' arguments, explorations, or needs/concerns might have been missed. Third, because this study mainly focused on SCAN, the topic of other VCA techniques was only surveyed to a minor extent. Fourth, we only surveyed practitioners who followed SCAN training in Belgium between 2012 and 2018. Practitioners who followed SCAN training outside Belgium, followed training in other VCA techniques, or had no training were not surveyed. Their relevant insights, needs and concerns about other techniques are thus missing in this study. As such, the external validity of the practitioners' results with regard to other VCA techniques should be interpreted with caution.

Nevertheless, we believe the external validity with regard to the practitioners' results on SCAN is noteworthy. We argue that our predominant qualitative results on SCAN are generalizable to all practitioners who followed SCAN training in Belgium for two reasons. On the one hand, the study sample covers a large part (34%) of the population. On the other hand, given the sample's consistent viewpoints on SCAN and the compared similarities between the demographics of the sample and the population, our sample is considered a fair representation of the population. Even though the sample consisted of 57% police officers, the results are also applicable to other practitioners in judicial, private, or inspectorate services who followed SCAN training in Belgium. The majority of motivations on the use(fulness) of SCAN is not field specific. The study's main results on SCAN also seem to reflect an international trend and can be mirrored to other countries as well. More specifically, it appears that the majority of practitioners' motivations why SCAN is not or partially used (i.e., complexity, lack of academic support, lack of clarity on how to use SCAN, time consuming nature, ignoring language barriers, unavailability of written statements, the impact of the consultation with/presence of a defence lawyer),

are not country-specific or bound to a specific legal system and may thus also be at stake in law enforcement practice outside of Belgium.

Recommendations for academia and practice

1. *Practitioners must make the leap toward other techniques than SCAN*

Our first recommendation encourages practitioners to make the shift toward other academically established investigative interviewing practices and VCA techniques than SCAN. As most practitioners are not familiar with other tools, practitioners' knowledge of existing academically sound techniques must be enhanced. In first instance, properly adopting investigative interviewing practices already warrants the obtainment of accurate and reliable information. To enable practitioners to incorporate VCA techniques in their interview style it is, however, crucial that they are trained to properly adopt investigative interviewing styles in practice (Vrij et al., 2022). In this regard, also identifying inconsistencies that require further investigation is important (UN Principles on Effective Interviewing for Investigations and Information Gathering, 2021). In addition, academically underpinned VCA techniques[11] with higher diagnostic value, of course, do already exist. However, it should be noted that such VCA techniques appear unappealing to practitioners (Vrij et al., 2022). Whereas the results from our study demonstrate that practitioners, amongst other things, demand techniques that can be used verbally and in real-time in every day police questioning, most VCA techniques require coding after the interview has been conducted, either or not based on interview transcripts including a lot of details. As such, not all VCA techniques allow to address practitioners' needs or real-life police questioning situations.

Nevertheless, some VCA techniques (VA, complications, and plausibility) are promising in this regard, as they allow to assess the statement's veracity verbally and in real-time (see Vrij et al. (2022) for a detailed analysis). They can also be used by police officers independently. The results from a recent meta-analysis (Verschuere et al., 2021) on the VA show that focusing on the number and content of verifiable details in statements allows to get a grasp of the truthfulness of statements, because it appears that truth-tellers report more verifiable details than liars. Whereas all verifiable details cannot be easily assessed in real-time, it is manageable to assess verifiable sources in real-time, which are also indicative of truthfulness in statements (Vrij et al., 2022; Leal et al., 2018; Vrij et al., 2019; Vrij et al., 2021a). The same goes for focusing on complications mentioned in a statement. Complications are '*clusters of details that make the story more complicated'* (Vrij et al., 2022, p. 4). Complications are expressed more often by truthtellers than liars and can be counted in real-time during police questioning (Vrij et al., 2021b; Vrij et al., 2022). In addition, the overall impression of the likelihood of what happened in the way it was described – the plausibility of the statement as a verbal cue – can be determined in real-time too and also allows to assess truthfulness (Leal et al., 2019, Vrij et al., 2021c, Vrij et al., 2022). As can be noted, these promising techniques focus on cues to truthfulness instead of deception detection, whereas practitioners appear to focus on deception detection instead (Vrij et al. 2022). Given

[11] For a more detailed overview of the content and method of these techniques and a discussion of their added value for practice, see Vrij et al. (2022).

that the current state of the art mostly provides promising results on techniques focusing on cues to truthfulness, practitioners should be taught and convinced to step away from lie and deception detection attempts. In this way, practitioners can embrace a focus on information gathering and such cues to truthfulness. In the meantime, future research could further examine the diagnostic value of cues to deception with a view to developing a tool that includes both cues to truthfulness and deception (Vrij et al., 2022).

2. *Academic VCA knowledge must be translated to practice*

Our second recommendation builds upon our finding that academic conclusions are hardly implemented in (Belgian) practice, which is consistent with the international call of Nahari et al. (2019) to make academic knowledge on VCA more accessible for practitioners. Creating a shift toward the other useable VCA techniques mentioned above requires the translation of academic research to practice and the distribution of the above mentioned academically sound practical alternatives (Nahari et al., 2019; ten Brinke & Porter, 2013). To foster the implementation of such techniques in practice (and relevant future academic research), it is essential to establish a cross-fertilization and dialogue between practice and academics. Such cross-fertilization can be obtained via three main initiatives.

First, this can be facilitated by organising trainings. It is foremost important to enhance training practices on police questioning and interviewing techniques in general. Indeed, research has shown that the widely recommended information gathering interview style and investigative interviewing practices are not (adequately) used in practice (Principles on Effective Interviewing for Investigations and Information Gathering, 2021; Vrij et al., 2022). Police officers across Europe (e.g., Belgium, the Netherlands, Spain) conducting police interviews appear to be insufficiently trained to properly do so (Schell-Leugers et al., 2022; Van Beek & Hoekendijk, 2016; Vanderhallen et al., 2016). Academically underpinned practical training of sufficient length, including practical sessions is, however, required to allow practitioners to deploy the necessary skills to conduct police interviews (Principles on Effective Interviewing for Investigations and Information Gathering, 2021). Academically founded VCA techniques should be incorporated in such practical training (see also Vrij et al., 2022). Second, a cross-fertilization can be obtained by conference days. Such conference days and workshops need to highlight the state of the art on VCA techniques. They also need to focus on practical guidelines on how and when to use certain techniques, taking into account the prevailing legal context and practical hurdles, as discussed in this study. They should address practitioners as participants and speakers.

Successful examples of such initiatives are the conference days and training programmes organised by the Belgian Centre for Policing and Security (CPS). In particular, both a conference day on the state of the art regarding investigative interviewing and VCA tools, as well as a periodic training programme were organised to address the needs coming forward from this study. The training programme consists of a two day training and one follow up day, including exercises and role plays. It teaches practitioners to adopt an information gathering interview style, as well as to include several academically underpinned VCA techniques (for example the VA). As such, the training also aligns with the UN endorsed Principles on Effective Interviewing for Investigations and Information Gathering (2021) in which adequate training

is prescribed. In addition, it demonstrates that VCA techniques can be incorporated in current interviewing styles when practiced and taught by trainers who are up to date on the current state of the art. In this regard, we observed from previous trainings that it is worthwhile to have an academic and renowned practitioner teach together. This warrants academic underpinning and quality monitoring, as well as support for the training by the participants.

A third way to foster cross-fertilization is by conducting research that allows to make VCA techniques more attractive to practitioners. Academics can facilitate this by adjusting existing VCA tools or by developing completely new techniques (Vrij et al., 2022). Building further on the current study, academics should try to (1) address pressing issues in police questioning practice (such as the real-time use of techniques that do not require coding after the interview, and the diagnostic value of cues to deception for developing a tool that includes cues to both truthfulness and deception), (2) survey a large sample of (international) practitioners on their needs and concerns about alternative VCA techniques, (3) focus on a comprehensive comparison of the current study's data with existing techniques, and (4) survey a larger sample of academics to grasp additional insights on the opportunities of other VCA techniques. In addition, academics should maximize the ecological validity when conducting research by including practitioners as participants.

We believe that the current study serves as an important step to bridge the gap between academics and practitioners with regard to SCAN and VCA techniques in general. Through an enhanced cooperation, we cannot only fill gaps in research, but we can also make a difference for police practice, prevent tunnel vision and miscarriages of justice (ten Brinke & Porter, 2013), and enhance today's essential evidence-based policing (Knutsson & Tompson, 2017). The current study tried to serve as an example of a cross-fertilization between academia and practice by including practitioners' in the study, by providing academically sound alternative techniques based on practitioners' needs and concerns, and by serving as a first impulse for organising relevant investigative interviewing/VCA conference days and training programmes.

Conclusion

SCAN fails to detect deception, but is still used by practitioners in a slimmed-down and personalised form. SCAN is also considered incompatible with (Belgian) legislation on police questioning. By analysing why and how practitioners use the academically unsound SCAN, the present study illuminates some important practitioners' needs and concerns to foster the shift toward other VCA techniques or investigative interviewing practices. Practitioners require a technique for everyday police questioning with both verbal and non-verbal indicators. The technique must furthermore be used independently by police officers and must fit within the current legal context (e.g., access and presence of defence lawyers prior and during police questioning). Practitioners also require a technique that is accompanied by sufficient and periodic training. In addition, they ask for the most time efficient technique that can be used in real-time during police questioning. Most VCA techniques, however, require coding after the interview and do not meet the need for real-time use in every day police questioning. Nevertheless, some VCA techniques allow to assess the statement's veracity verbally and in real-time, such as the

VA, complications mentioned in the statement, and the plausibility of the statement. Our results, however, suggest that academic VCA research hardly reaches practitioners, which contributes to the fact that practitioners tend to keep on using SCAN instead of making the shift toward other VCA techniques. Academics can bridge that gap and foster the implementation of other VCA techniques by (1) organising academic underpinned practical training and conference days, incorporating practical guidelines, the prevailing legal context, and practical hurdles, as well as (2) by conducting research that adjusts existing VCA tools or develops completely new techniques and maximizes ecological validity by including practitioners as participants.

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Data availability statement

Data is not available due to ethical restrictions. Participants of this study did not provide consent for their data to be shared publicly, so supporting data is not available.

Standard Reviewer Statement for Disclosure of Sample, Conditions, Measures, and Exclusions

The authors have reported all measures, conditions, data exclusions, and how they determined their sample sizes. The authors have no other related studies (including pilot tests) to report.

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Article 47*bis* Belgian Code of Criminal Procedure. https://www.ejustice.just.fgov.be/cgi_loi/change_lg.pl?language=nl&la=N&cn=1808111730&table_name=wet

Article 2*bis* Belgian Pre-trial detention Act. https://www.ejustice.just.fgov.be/cgi_loi/change_lg.pl?language=nl&la=N&table_name=wet&cn=1990072035

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Appendices

Appendix 1. Research protocol scoping review

This scoping review is based on the steps of Verhage & Boels (2015) and Arksey & O'Malley (2005).

Research question: 'What is known about Scientific Content Analysis (SCAN)?'

Inclusion criteria	1. Primary and secondary research involving SCAN 2. Published 3. From 2000 until 2022 4. In Dutch or English

Search places	Databases	Web of Science Scopus Hein Online
	Academic search engines	Google scholar
	Search engines	Google
	General catalogues	Lib Ugent
	Journals	Panopticon Criminal justice and behaviour Legal and criminal psychology Frontiers in psychology

Search terms	English	1. 'Scientific Content Analysis' OR SCAN 2. 'Scientific Content Analysis' OR SCAN AND (Sapir OR scientific research OR Statement Analysis OR Verbal veracity assessment OR Deception detection OR Lie detection)
	Dutch	1. 'Scientific Content Analysis' OF SCAN 2. 'Scientific Content Analysis' OF SCAN EN (Sapir OF wetenschappelijk onderzoek OF misleidingdetectie OF leugendetectie OF verbale analysemethode)

Longlist: 35 studies

Shortlist: 18 studies

1. Armistead, T. W. (2011). Detecting deception in written statements: The British Home Office study of scientific content analysis (SCAN). *Policing: An International Journal of Police Strategies & Management, 34*(4), 588-605.

2. Bockstaele, M. (2019). SCAN versus experimenteel wetenschappelijk onderzoek. *Panopticon, 40*(2), 120-135.
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Appendix 2. Practice-oriented questionnaire

Introduction

1. Which target group do you belong to? (police, judicial system, private sector, inspectorate service, other)
    a. If police, which unit?
    b. If other than police, what organisation do you work for?
2. What is your position within this organisation?

SCAN training

3. In which year did you follow the CPS SCAN training? (2012, 2013, 2014, 2015, 2016, 2017, 2018)
4. How satisfied or dissatisfied are you with this training? (Very satisfied - Somewhat satisfied - Not satisfied and not dissatisfied - Somewhat dissatisfied - Very dissatisfied)
5. How did you experience the teaching style?
6. What did you think of the training materials?
7. How did you experience the interaction with the teacher and other students?
8. Why did you attend this training? (obligatory, out of interest, other reason)
9. Did you participate in the SCAN follow-up training? (Yes, no)
10. Did you start using SCAN as a result of the training?
11. In addition to SCAN training, would you like to receive training in other lie or deception detection techniques? (Yes, no, no opinion)
12. If you have any other comments about the training, you can post them here.

Use

13. Why do you or do you not use SCAN during your professional activity?
14. How frequently do you use SCAN (always - in more than half of interviews - in about half interviews - in less than half of interviews - never)
15. How do you experience the use of SCAN from a practical perspective? This could involve the user (un)friendliness, the time SCAN takes, etc.
16. Do you use all 16 SCAN criteria? (I use all criteria, I do not use all criteria)
    a. If not, which do you use?
        - change in language use
        - lack of memory of the event
        - unnecessary links
        - out of sequence information
        - the place of emotions within the statement
        - sensory perceptions
        - details within statement

- spontaneous denials/corrections
- inappropriate use of pronouns
- structure of the statement
- not answering the question
- evasive answers
- change in verb tense
- lack of social introduction
- missing information (text bridges)
- time

b. If not, why do you not use certain criteria?

17. With which target group(s) do you use SCAN? (Suspects, witnesses, victims, other)
18. In what type of interviews do you use or do you not use SCAN? Why?
19. Avinoam Sapir, the author of SCAN, distinguishes 6 different steps to be followed: the initial phase, obtaining the pure version, the analysis, subsequent interviews, detailed interview and debriefing. Which steps do you complete? (indicate)
    a. If you do not complete all steps, what is a reason for this?
20. What results have you already achieved through the application of SCAN?
21. Did SCAN already provide breakthroughs and/or false leads in certain interviews?
    a. If yes, what breakthroughs and/or false leads?

<u>Perception and future perspective</u>

22. What are SCAN's positive points?
23. What are SCAN's negative points?
24. How could these negative points be addressed?
25. Why will you or will you not use SCAN in the future?
26. Are you familiar with other methods of analysing statements, such as Statement Validity Assessment/Criteria Based Content Analysis and/or Reality Monitoring? (Yes, no)
    a. If yes, do you use one or more of these techniques? (Yes, no)
    b. If you have a choice between SCAN, Statement Validity Assessment/Criteria Based Content Analysis and Reality Monitoring, which technique do you prefer and why?
    c. If yes, do you think it is possible to integrate SVA, RM and SCAN? (Yes, no, I don't know)

<u>Propositions</u> (totally agree, agree, neutral, disagree, totally disagree)

27. I think SCAN training should be organised.
28. I use the person's writing time as extra preparation time.
29. SCAN can help keep the investigation's directions broad and thus reduce the risk of tunnel vision.
30. SCAN does not offer an added value during investigations.

31. I am aware of scientific studies and conclusions involving SCAN.
32. The application of SCAN takes a lot of time.

Descriptives

33. What is your name? (optional)
34. What is your age? (optional)
35. What is your gender? (optional)
36. What is your email address? (optional)
37. Are you in your current professional activity involved in taking statements/interviewing? (Yes, No)
38. Would you like to be contacted in the future for a follow-up study? (Yes, No)

If you have any further comments, please feel free to submit them here.

Thank you very much for participating in the survey!

Appendix 3. Academics-oriented questionnaire

Introduction

1. Which target group do you belong to? (professor, doctor, (PhD) researcher, assistant)
2. What organisation do you work for?

SCAN training

3. Did you follow a SCAN training? (Yes, no)
    a. If yes, where did you take this training? (Centre for policing and security, other)
    b. If CPS
        i. In which year did you follow the CPS SCAN training? (2012, 2013, 2014, 2015, 2016, 2017, 2018)
        ii. How satisfied or dissatisfied are you with this training? (Very satisfied - Somewhat satisfied - Not satisfied and not dissatisfied - Somewhat dissatisfied - Very dissatisfied)
        iii. How did you experience the teaching style?
        iv. What did you think of the training materials?
        v. How did you experience the interaction with the teacher and other students?
        vi. Why did you take this training? (obligatory, out of interest, other reason)
        vii. Did you participate in the SCAN follow-up training? (Yes, no)
        viii. Would you set up training in other lie and/or deception techniques? If yes, what techniques?
        ix. If you have any other comments about the SCAN training, please post them here.
    c. If no, do you see yourself doing this in the future? (Yes, no, I don't know)

Perception and future perspective

4. To what extent are you familiar with the scientific literature involving SCAN? (I am aware of the studies and conclusions, I have notions of the studies and conclusions, I do not know the scientific literature surrounding SCAN, other)
5. To what extent are you familiar with the content and operation of SCAN? (I know the full content and operation, I have notions of the content and operation, I do not know SCAN, other)
    a. *Academics were presented an introduction text regarding SCAN and its content and operation.*
6. What do you think is the main purpose of SCAN?
7. Did you already apply SCAN yourself in practice? (Yes, no)
8. What are negative points of SCAN?
9. How could these negative points be addressed?
10. What are positive points of SCAN?
11. May SCAN be applied in practice? (Yes, no)

a. Why yes/no?
b. If yes, how?
c. If not, are there certain alternatives that you do support?

12. Are you familiar with other methods of analysing statements, such as Statement Validity Assessment/Criteria Based Content Analysis and/or Reality Monitoring? (I know both, I know Statement Validity Assessment/Criteria Based Content Analysis, I know Reality Monitoring, I know neither)
    a. Do you see SCAN as an added value, less value, or neither compared to this/these technique(s)? Why?
    b. To what extent is it possible to integrate SCAN, Statement Validity Assessment/Criteria Based Content Analysis, and/or Reality Monitoring? If these techniques could be integrated, in what way?
13. What is your future outlook on SCAN?

Scientific research regarding SCAN

14. Suppose you had unlimited time and resources, how would you design a new study of SCAN?
15. What do you think is the added value of investigating SCAN in an experimental setting?
16. What do you think is the added value of conducting research in and with practitioners on SCAN?

Propositions (totally agree, agree, neutral, disagree, totally disagree + why?)

17. SCAN encourages false positive errors.
18. A laboratory testing situation is not a reliable reflection of social reality when research is conducted on lie or deception detection.
19. SCAN does not claim to be able to determine whether a person is lying or not. In the scientific studies published so far, SCAN is tested as a lie detection method, which defeats the original purpose of SCAN.
20. SCAN does not offer an added value during investigations.
21. I think SCAN training should be organised.

Descriptives

22. What is your name? (optional)
23. What is your age? (optional)
24. What is your gender? (optional)
25. What is your email address? (optional)
26. Would you like to be contacted in the future for a follow-up study? (Yes, No)

If you have any further comments, please feel free to submit them here.

Thank you very much for participating in the survey!