The Verifiability Approach: A meta-analysis

Nicola Palena[a]*

Department of Human and Social Sciences, University of Bergamo (Italy)

Letizia Caso[b]

Department of Human and Social Sciences, University of Bergamo (Italy)

Aldert Vrij[c]

Department of Psychology, University of Portsmouth (UK).

Galit Nahari[d]

Department of Criminology, Bar-Ilan University, Ramat-Gan, Israel

*Correspondence concerning this article should be addressed to: Nicola Palena, University of Bergamo, Department of Human and Social Sciences, Piazzale S. Agostino, 2, 24129, Bergamo (Italy), ph. 0039 334 92 45 482, email: dr.nicola.palena@gmail.com

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Abstract

The Verifiability Approach (VA) is a verbal veracity tool that assumes that truth tellers provide more details that can be verified and obtain a higher ratio of such details (verifiable details/total details) than liars. A VA meta-analysis was conducted. Results showed that truth tellers reported more Verifiable Details than liars (k = 20, N = 1532, g = 0.42). The effect was moderated by the presence of the Information Protocol and by the nature of the statement (event-related or not). Truth tellers reported a higher ratio of Verifiable Details than liars (k = 18, N = 1359, g = 0.49). The effect was moderated by the medium through which the statement was provided. Unverifiable details did not discriminate truth tellers from liars (k = 15, N = 957, g = -0.25). In conclusion, results showed good potential for the use the VA, although replications and field studies are needed.

Keywords: Verifiability approach; verifiable detail; checkable details; meta-analysis

General audience abstract

The current article presents a meta-analysis examining the efficacy of the Verifiability Approach (VA) for lie detection purposes. This approach predicts that truth tellers report more details that can be verified than liars. It also predicts that the ratio of verifiable details (verifiable details/total details) is higher for truth tellers than for liars. The results showed that both the frequency of verifiable details and their ratio did discriminate truth tellers from liars, with moderate effect sizes. Unverifiable details did not distinguish truth tellers from liars. For verifiable details, the analyses showed a moderating role of the presence or absence of an Information Protocol. The VA was more effective when the Information Protocol was present, that is, when interviewees were informed about the rationale of the VA and were told in advance that the details they provide would be checked. The VA discriminated better between truth tellers and liars when the nature of the statement was event-related than when it was not. For the ratio of verifiable details, moderator analyses showed that the VA was more effective when participants were asked to write their statements than to verbally recall their statements. The present article thus indicates that the VA can be used as a veracity assessment tool, particularly when the Information Protocol is included.

The Verifiability Approach: A meta-analysis

The Verifiability Approach (Nahari, 2018) is a strategy-based veracity assessment tool. According to the VA, liars face a dilemma when providing their accounts. On the one hand, they are tempted to add details to appear credible. On the other hand, they want to avoid adding details to reduce the possibility that, by checking the details provided, the interviewer will discover that they are lying. As a solution, liars may report details that are not verifiable and leave out details that are verifiable. In contrast, truth tellers typically adopt a forthcoming 'tell it all' strategy (Strömwall, Hartwig, & Granhag, 2006; Vrij, Mann, Leal, & Granhag, 2010), as they have nothing to hide. They are willing to report both unverifiable and verifiable details. The VA thus predicts that truth tellers report more details that can be verified (Verifiable Details) than liars and that the ratio Verifiable Details/total details will be higher for truth tellers than for liars.

According to Nahari's definition (Nahari, Vrij, & Fisher, 2014a), details are verifiable when they are: a) documented (e.g., by CCTV video, phone calls, payment with debit cards or signed documents); b) carried out with another identifiable person (*"I was at the restaurant with my friend Mark")*, or c) witnessed by another identifiable person ("*I argued with a stranger in front of my sister*"). As such, each Verifiable Detail has an evidence source that can be either an identifiable person who can be questioned, or some kind of documentation (physical, analogical or digital) that can be checked.

In the first ever VA experiment, participants were instructed to tell the truth or lie about recent activities they had completed (Nahari, Vrij, et al., 2014a). Analysing participants' written statements showed that compared to truth tellers, liars included fewer Verifiable Details and a similar amount of unverifiable details, resulting in a lower ratio of verifiable/unverifiable details. Following this experiment, Nahari, Vrij, and Fisher (2014b) examined the vulnerability of the VA to countermeasures (i.e., the extent to which someone who knows the VA can adjust his/her responses so that s/he comes across as truthful). Participants were again instructed to tell the truth or lie about recent activities they had completed. In addition, half of the participants were informed in advance that the veracity of their account would be determined by its verifiability level (i.e., Information Protocol) whereas the other half were not informed. Providing this information encouraged truth tellers, but not liars, to provide more Verifiable Details.

After the publication of the first studies by Nahari et al. (2014a, 2014b), which focused on criminal investigating interviewing, several new experiments were conducted to examine the VA in an insurance setting. In those experiments, participants were asked to submit a claim about an actual

(truth tellers) or fabricated (liars) incident of a damaged/stolen object. Replicating the effect found in mock crime settings, those studies showed that truth tellers reported more Verifiable Details than liars (Harvey, Vrij, Leal, Lafferty, & Nahari, 2017; Harvey, Vrij, Nahari, & Ludwig, 2017; Vrij, Nahari, Isitt, & Leal, 2016), but only when the Information Protocol was applied. This in contrast to results in criminal settings where the Information Protocol strengthens the veracity effect (i.e. a difference between truth tellers and liars in the amount of verifiable detail) but is not necessary for the veracity effect to occur. The VA was also found effective in an airport setting (Jupe, Leal, Vrij, & Nahari, 2017; Vrij et al., 2019), where real travellers were interviewed at an airport about their travel plans. The attempts to examine the VA in non-event settings, such as malingering (Boskovic, Bogaard, Merckelbach, Vrij, & Hope, 2017; Boskovic et al., 2019; Boskovic, Gallardo, Vrij, Hope, & Merckelbach, 2018) and occupational settings (Jupe, Vrij, Nahari, Leal, & Mann, 2016) were unsuccessful, because Verifiable Details did not discriminate between truth tellers and liars in these settings. Hence, the available literature shows the potential of the VA for lie detection purposes in various but not all settings.

In an overview of verbal veracity tools, (Vrij & Fisher, 2016) concluded that the VA may be ready to be used in real life. However, as discussed above, there is variability across studies, which is reflected also in terms of effect sizes (Bogaard, Meijer, & Van der Plas, 2019). Therefore, a meta-analysis is needed to explore the stability of the VA veracity effect as well as to identify the role of possible moderators. The aim of the present meta-analysis is to examine the main VA prediction: *Do truth tellers report more (and/or a higher ratio of) verifiable details than liars?* The difference between truth tellers and liars in the amount of unverifiable details was explored but not hypothesised as there is no sound theory available to make a hypothesis.

We examined four moderators. One moderator is the application of the Information Protocol, by which the interviewees are informed about the rationale of the VA and told in advance that the veracity of their accounts will be checked by the level of verifiability. Differences between truth tellers and liars should become more profound when the Information Protocol is applied, because it should encourage truth tellers more than liars to report Verifiable Details. Another relevant moderator is the nature of the interview. The VA was originally developed within police interviewing settings, but it was later applied to other settings. We dichotomised these settings into event-related or non-event related. According to our definition, event-related settings concern occurrences with an external source, where the interviewees are asked to describe their (actual or planned) whereabouts in a specific time frame. Non-event related settings refer to occurrences with an internal source or knowledge, where the interviewees are asked to describe their emotional,

mental or physical experiences, images of locations and people they know, habits, skills or education. Since the verifiability sources – documentation and a third identifiable person – are also external to the person, they should be able to verify occurrences with an external source but not those with an internal source. For example, CCTV can record whereabouts of a person but not his emotions, thoughts, physical symptoms or his knowledge. Similarly, a person can testify about others' activities or clothes (which they can perceive through their senses) but not about others' headache, feelings, education or skills (which they cannot perceive through their senses) (see also Nahari, 2019). Consequently, the opportunity for truth tellers to provide verifiable details is much greater in event-related settings than in non-event related settings. Hence, it is expected that the difference between truth tellers and liars is larger in event-related than in non-event related settings. The third moderator was the medium (oral or written) in which the interviewees' statements are provided. The medium can influence deception cues as someone has more time to think about the content of the statements when writing than when speaking (Sporer, 2016). Written statements give more opportunity to the interviewee to think what to report than oral statements. Further, it has been found that the medium by which a statement is provided can affect the amount of detail reported by witnesses with more details reported in a written modality than in the spoken modalities (Sauerland, Krix, van Kan, Glunz, and Sak (2014, Experiment 1). The medium is thus expected to moderate the differences between truth tellers and liars in the amount of Verifiable Detail. The final moderator was motivation of the participants. Research has shown that it was easier for observers to discriminate truth tellers from liars when the senders were motivated vs. unmotivated (Bond Jr. & DePaulo, 2006), reflecting DePaulo et al. (2003) meta-analysis of cues to deception where it was found that cues to deception were more evident in motivated vs unmotivated senders. Hence, it is expected that motivation can moderate the difference between truth tellers and liars in the amount of detail they report.

Method

Inclusion criteria

We searched the literature for empirical studies testing the VA. We used the following inclusion criteria: (1) interviews involving one interviewee (rather than pairs of interviewees, see Leal et al., 2018; Nahari & Vrij, 2014; Vernham et al., 2020); (2) the veracity (truth telling vs. lying) of the statements is manipulated either between-subjects (i.e., interviewees either lied or told the truth) or within-subjects (i.e., interviewees both lied and told the truth during the interview); (3) studies including the frequency of Verifiable Details and/or the ratio verifiable/total details and the frequency of unverifiable details[1]; (4) studies that are based on a single interview (rather than

repeated interviews); (5) studies in which the transcripts of interviews are coded manually following Nahari's et al. (2014a) original working definition of Verifiable Details (rather than the source of Verifiable Details; e.g.: Leal et al., 2018; Vrij et al., 2019; Vrij, Mann, Leal, & Fisher, 2020); (6) articles are written in English; and (7) articles are published in peer-reviewed journals. The decision whether or not to include grey literature in a meta-analysis is controversial (Bellefontaine & Lee, 2013) as both choices have advantages and disadvantages (Benzies, Premji, Hayden, & Serrett, 2006). There are at least three main reasons why studies are unpublished (grey literature). First, the study obtained null findings. Excluding papers for this reason is a concern and may result in an overestimation of the true effect size (Borenstein, Hedges, Higgins, & Rothstein, 2011; Hopewell, Clarke, & Mallet, 2005). However, nowadays journals are less inclined than in the past to reject articles due to null findings, making this issue less problematic than in the past. In fact, our meta-analysis include three studies (about 21%) that obtained null findings (Bogaard et al., 2019; Boskovic et al., 2018; Nahari, Leal, Vrij, Warmelink, & Vernham, 2014). Second, the study may be of poor quality and did not pass the peer review process or did not undergo it at all (Sacks, Reitman, Pagano, & Kupelnick, 1996). Excluding papers for this reason is not a concern, but an advantage. Peer process is a crucial mechanism available to science to guarantee quality and this should not be undermined by allowing poor quality research to enter the scientific literature through the meta-analysis back-door. Third, the study is still under review or not yet submitted for publication but will eventually get published. Missing out on these studies could be concerning because it means the meta-analysis will soon be dated. However, this is always the case in the quickly growing field of verbal lie detection. We think that the poor quality reason outweighs the other two reasons, which made us decide to include peer-reviewed articles only.

Notwithstanding our choice to include only published articles, we searched the grey literature. In addition to the database search reported above, we searched the 2019 conference programs of the European Association of Psychology and Law (EAPL), the American Psychology and Law Society (AP-LS) and the International Investigative Interviewing Research Group (iiiRG). The EAPL conference search resulted in a source, but that was a theoretical rather than empirical source which was already found using the keywords we selected (Nahari & Nisin, 2019b). The AP-LS and iiiRG search did not result in any source. We also searched on ResearchGate where we found a source written in German (Körner & Urban, 2018), which would have been excluded because of the language inclusion criterion, and a paper by Verschuere, Schutte, Van Opzeeland, and Kool (unpublished study) which is unpublished source. Finally, from the first authors of previous VA publications (Bogaard, Boskovic, Harvey, Kleinberg, Jupe, Nahari, Vrij) only Boskovic currently has a VA paper submitted for review. This makes us think that not many grey

literature studies are present at the moment, which would reflect the general finding that the proportion of grey studies as a percentage of published studies is typically small (Bellefontaine & Lee, 2013).

Moderator analyses

For each study, we coded whether or not an Information Protocol was provided. We also coded the nature of the statement. Studies that involved the following settings were grouped under the label "event-related": i) Insurance claim setting where participants were asked to provide an insurance claim about loss, damage or theft of goods; ii) criminal setting where participants were interviewed about their involvement in a mock crime; iii) airport setting, where participants were questioned about their forthcoming trips; iv) personal event setting, where participants were interviewed about an autobiographical event. Studies that involved malingering, where participant were interviewed about their health (e.g.: physical symptoms), or an occupation setting, where participants were questioned about their jobs, were instead grouped under the label "non-event". We further coded the medium through which participants were interviewed (oral statement or written statement). Lastly, we explored the effect of the level of participants' motivation to appear credible. Motivation was coded as "low", "medium" or "high", following Hauch, Sporer, Michael, and Meissner's (2016) coding scheme.

Search strategies and selection of studies

The literature search was conducted in December 2019, using the following databases: PsycINFO, PsycARTICLES[2], Scopus, and Web of Science, looking for articles and reviews that included the terms ("verifiab* detail*" OR "verifiab* approach" OR "checkable detail*", in title/abstract/keywords) and ("decept*" OR "deceit" OR "lie" OR "lying" OR "truth*", in title/abstract/keywords) and did not include the terms ("collect*" OR "pair*" in title/abstract/keywords). Furthermore, we searched i) in the reference list of the selected papers for additional relevant studies not found via the database search; and ii) on the webpages of scholars working on the VA. The selection process was based on two steps and was made by two researchers with expertise in verbal lie detection. First, the selection was based on titles and abstracts of the retrieved references. Second, the articles were read in full to select those papers which matched the eligibility criteria. Inter-rater agreement, expressed as percentage, was 100%, Appendix 1 reports the excluded studies, with the reason for exclusion (see supplementary material for illustration of the selection process via the Prisma diagram, Moher, Liberati, Tetzlaff, & Altman, 2010).

Coding

The same two researchers involved in the screening of the retrieved references used a coding protocol to extract all the relevant information needed for the meta-analysis. To ensure that the process was as accurate as possible, a simplified Stock's training process was followed (Cooper, 2015). First, the coding scheme was agreed upon. Second, the coding was tested. Any disagreement that arose in any of these two steps was discussed and resolved until the two coders agreed. Third, the coding scheme was applied. It involved: (a) characteristics of the sample (sample size, gender, age); (b) the absolute frequency (mean and standard deviation) of Verifiable Details; (c) the ratio of verifiable/total details (mean and standard deviation); (d) the absolute frequency of unverifiable details; (e) the year of publication; (f) whether the Information Protocol was employed; (g) the nature of the statement; (h) whether the details were obtained from oral or written statements (medium); and (i) the level of motivation. Inter-rater agreement was of 95.85% (Cohen's *k* from 0.47 to 1). The coding of the first coder was used for the analyses.

Statistical analyses

The data obtained from the studies were analysed using standard meta-analytic procedures. Due to the dependency of the three outcome measures[3] we conducted three separate meta-analyses: One for the frequency of verifiable details, one for the ratio of verifiable details/total details, and one for unverifiable details. We obtained Hedges's *g* from the data reported in the papers when this was available. We computed Hedges's *g* as this is a better measure (less biased) than Cohen's *d* when a meta-analysis based on small sample of studies (Borenstein et al., 2011; Crocetti, 2015). We conducted the analyses so that positive values indicate a higher frequency of verifiable details and unverifiable details or a higher ratio of verifiable/total details for truth tellers than for liars. Confidence intervals (95%), standard error, variance and statistical significance of the effect sizes were also calculated. The individual effect sizes derived from individual studies were pooled to obtain an overall effect size through the inverse-variance method. Due to the possibility to generalise the results beyond the studies included in the analysis, and the possibility to account for various sources of variation (both within-studies and between-studies variance), we used the random-effects model.

Heterogeneity was assessed via the Q and the I^2 statistics. The statistics Q, if significant, indicates a lack of homogeneity between studies, whereas I^2 provides an estimation of the proportion of observed variance reflecting a real difference in effect sizes. An I^2 of 25% indicates a low difference, an I^2 of 50% a moderate difference and an I^2 of 70% indicates a high difference.

Furthermore, sensitivity analyses were conducted with the aim to explore the (in)stability of the results through computing the global effect size by removing one study at a time. Additionally, publication bias analyses were conducted exploring the funnel plot and by applying the trim and fill method. A funnel plot indicates a publication bias when there is an asymmetry of the effect sizes reported on the plot, whereas the trim and fill method indicates the lack of a publication bias if no study is trimmed or when there are only trivial differences between the estimated and the observed effect sizes.

Regarding the total number of verifiable details (k = 20), the dataset consisted of 1532 participants (659 of which told the truth, 728 lied, and 145 did both). Regarding the ratio of verifiable details (k = 18), the dataset consisted of 1359 participants (581 of which told the truth, 664 lied, and 114 did both). Regarding the total number of unverifiable details (k = 15), the dataset consisted of 957 participants (367 of which told the truth, 445 lied, and 145 did both). All subgroups were independent.

Results

Descriptive characteristics of included studies

Fifty-eight records were obtained searching the databases with the selected keywords and five records through other sources (e.g. searching on the website of scholars working on the VA). After removing the duplicates, the title and abstract of 29 documents were screened. Of these, 12 records were excluded: Nine of them did not focus on the VA (Alper, 2019; Deeb et al., 2018; Masip, 2017; Nieuwkamp, Horselenberg, & van Koppen, 2018; Vrij, 2016, 2018; Vrij & Fisher, 2016; Vrij, Leal, & Fisher, 2018; Vrij et al., 2017), two of them were theoretical rather than empirical (Nahari et al., 2019; Nahari & Nisin, 2019a), and one was excluded because pairs, rather than individuals, were interviewed (Nahari & Vrij, 2014).

The remaining 18 articles were read. Of these, four studies were excluded. Three articles were excluded because verifiable sources rather than verifiable details were coded (Leal et al., 2018; Vrij et al., 2019) and one article was excluded because it focused on liars' only (Nahari & Vrij, 2015).

The final sample therefore included 14 studies that matched the eligibility criteria. Of them, twelve studies employed a between-subjects design and two used a within-subjects design. One article included two independent studies with independent samples (Boskovic et al., 2017); the two

studies were analysed separately. Five articles included two independent subgroups with independent samples, where one subgroup was informed about the VA or received a Model Statement[4] and another subgroup was not (Bogaard et al., 2019; Harvey, Vrij, Leal, et al., 2017; Harvey, Vrij, Nahari, et al., 2017; Harvey et al., 2018; Nahari, Vrij, et al., 2014b); the two subgroups of each study were analysed separately. One article manipulated the presence/absence of the Information Protocol but included three subgroups: one was not informed about the VA, one was presented with a standard information protocol and one with an Enhanced Information Protocol (Jupe, Vrij, Leal, & Nahari, 2019). However, the authors did not report means and standard deviations for each of the three subgroups, but only the descriptives for the sample taken as a whole. For this article, it was not possible to obtain the descriptives for each independent group from the authors. Yet, since the Veracity by Information Protocol interaction was not significant, we opted to include the study in our analysis of the global effect size but excluded it from the moderator analyses concerning the presence/absence of the Information Protocol.

Concerning the outcome variable, ten articles reported both the total frequency and the ratio of verifiable details. Of these, one study (Jupe et al., 2016) was based on a within-subjects design, but we did not manage to obtain from the authors the correlation between truth telling and lying for the ratio of verifiable details. Hence, for this study, we only analysed the total frequency of verifiable details. Additionally, this study included three repeated Veracity conditions: truth, chosen lie (lie topic chosen by the interviewee), and forced lie (lie topic chosen by the experimenter). One study also study included three repeated Veracity conditions: truth tellers, coached liars[5], and naïve liars (Boskovic et al., 2018). Both Jupe et al. (2016) and Boskovic et al. (2018) would require multiple-comparisons. Yet, there is no consensus how they should be handled (Borenstein et al., 2011, pp. 208-209). Two possible solutions are: i) to conduct separate analyses for each comparison (in our example, truth tellers vs. chosen lie and vs. forced lies for Jupe et al., 2016, and truth tellers vs. coached liars vs. naïve liars for Boskovic et al., 2018); or ii) to aggregate the comparisons (in our example truth tellers vs. chosen and forced liars aggregated for Jupe et al., 2016 and truth tellers vs. coached and naïve liars aggregated for Boskovic et al., 2018). The first solution increases the overall likelihood of a type I error, whereas the second solution implies that any theoretical and applied distinction between the two groups that are aggregated are lost (Crocetti, 2015). Considering that: i) any possible moderating effect of forcing vs. choosing the lie and of coached vs. naïve liars cannot be explored since there is only one study including truth tellers, chosen, and forced lies and one including coached and naïve liars; and ii) we are mainly interested in interviewees who decide for themselves what to report in their statements, we opted to focus only on the comparison between truth telling and chosen lie for Jupe et al. (2016) and between truth

tellers and naïve liars for Boskovic et al. (2018). Three studies reported only the total frequency of Verifiable Details, but by contacting the authors we obtained the Ratio of Verifiable Details for two of them (Nahari, Leal, et al., 2014; Nahari, Vrij, et al., 2014a, 2014b). One study reported only the Ratio of Verifiable Details but by contacting the authors, we obtained also the total frequency of Verifiable Details (Nahari, Leal, et al., 2014).

Eventually, we analysed 20 samples for the frequency of Verifiable Details, 18 for the Ratio of Verifiable Details, and 15 for the frequency of unverifiable details. See the supplementary materials for the main characteristics of the included studies. All included studies are indicated with an asterisk in the reference list.

Total number of Verifiable Details

The meta-analysis of the 20 samples (k = 1532) on the frequency of Verifiable Details is reported in Table 1 and in the forest plot (see supplementary material). The analyses showed that truth tellers reported more Verifiable Details than liars. The effect size (g = 0.42) was moderate (Cohen, 1988). An evaluation of the residuals and their significance for each study showed that only one study (Nahari, Vrij, et al., 2014a) was an outlier. A sensitivity analysis showed that when this study was excluded the effect size was of g = 0.38, 95% CI [0.22; 0.54] and that the effect size for the total frequency of Verifiable Details remained stable when excluding one study at a time, ranging from g = 0.38 to g = 0.45. As shown in Table 1, there was heterogeneity between the studies. Moderator analyses (Table 2) showed a substantial difference between the effect sizes in the Information Protocol-present (g = 0.80) and Information Protocol-absent (g = 0.29) conditions. Furthermore, heterogeneity was high when the Information Protocol was employed (I^2 = 66.96) but moderate when the Information Protocol was not employed (I^2 = 48.83), which can be explained by the presence of the other moderators. The analyses showed an effect for the nature of the statement: The effect size differed significantly from zero for the event-related category (g = 0.56), but not for the category 'non-events' (g = 0.08). The effects for medium and motivation were not significant. The funnel plot (see supplementary material) appears asymmetric to some degree, and two studies were trimmed using the trim and fill method. This may point toward a possible publication bias, yet, the observed (g = 0.42) and estimated (g = 0.36) effect sizes for the total frequency of Verifiable Details were comparable, both in the range of a moderate effect sizes.

Ratio of Verifiable Details

The meta-analysis of the 18 (k = 1359) samples on the Ratio of Verifiable Details is reported in Table 1 (see supplementary material for the forest plot), which shows that truth tellers reported a

higher Ratio of Verifiable Details than liars. The effect size was moderate (g = 0.49) and comparable to that of frequency of the Verifiable Details effect size (g = 0.42). The meta-analysis also showed high heterogeneity (I^2 = 69.35). An evaluation of the residuals and their significance for each study showed that only one study (Harvey, Vrij, Leal, et al., 2017, subgroup 2) was an outlier. A sensitivity analysis showed that when this study was excluded the effect size was of g = 0.41, 95% CI [0.24; 0.58] and that the effect size remained stable when excluding one study at a time, ranging from g = 0.41 to g = 0.53. Table 3 shows that only the moderator 'medium' had an effect. The effect size was larger when participants provided written statements (g = 0.58) than oral statements (g = 0.23). The fact that the funnel plot appears symmetrical (see supplementary material) and that 0 studies were trimmed with the trim and fill method shows that a publication bias was absent. Indeed, the observed and the estimated effect sizes were identical.

Total number of unverifiable details

The meta-analysis of the 15 (k = 957) samples on the total number of unverifiable details is reported in Table 1 (see supplementary material for the forest plot), which shows that truth tellers reported fewer unverifiable details than liars (g = -0.25). The meta-analysis showed high heterogeneity (I^2 = 89.20) and an evaluation of each study showed that both independent subgroups in Harvey, Vrij, Leal, et al. (2017) were outliers. Reconducting the analysis without these two samples led to an almost null effect size of g = -0.02, 95% CI [-0.35; 0.31], indicating that this study was able to drive to very different conclusions. In neither of the cases any study was trimmed via the trim and fill method, meaning that the observed and expected effect sizes were identical in both cases. However, when Harvey, Vrij, Leal, et al. (2017) was included, the funnel plot appeared as more asymmetrical than when it was included (see supplementary material), meaning that a publication bias is more likely in the former case than in the latter. Table 4 shows that when Harvey, Vrij, Leal, et al. (2017), was included, the only significant moderator was the medium. When participants provided written statements, truth teller reported fewer unverifiable details than liars (g = -0.41, 95% CI [-0.83; 0.01]), whereas when participants provided an oral statement the opposite pattern appeared (g = 0.36, 95% CI [-0.17; 0.89]). When the study was excluded from the analysis no moderator had an effect.

Risk of bias and relation among moderators

An assessment of the risk of bias (for a detailed description see Higgins et al., 2011) was carried out by the two coders. The agreement was high for all seven measures, percent of agreement ranging from 86% to 93% (a graphical description of the risk of bias is reported in supplementary

material). The figure shows that studies implied low risk of bias in general. High risk was obtained on "Random sequence generation"[6] for two studies (Boskovic et al., 2017; Boskovic et al., 2018), as the allocation to the veracity condition was not completely random (truth tellers were participants who actually experienced symptoms, and were not assigned to this condition by the experimenters).

In the present meta-analysis, several moderators were explored. It is thus important to explore whether there was any association between the moderators. This was examined using Cramer's V, which can range from 0 (no association) to 1 (perfect association). According to Cohen (1988) a Cramer's V of 0.10 is a small effect, a value of 0.30 is moderate and a value of 0.50 and above is a large effect. Three associations (Information Protocol by Setting, Motivation by Setting, and Medium by Setting) showed effect sizes between Cramer's V = 0.09 to 0.20. Two associations (Information Protocol by Medium and Motivation by Medium) showed effect sizes of Cramer's V = 0.44 and 0.47. The only statistically significant association was between Information Protocol and Motivation, Cramer's V = 0.52, $p < .05$. About 31% of studies with an Information Protocol were in the category "low motivation" whereas 0% in the category "medium motivation". The percentage of studies without an Information Protocol with low (about 31%) and with medium (about 36%) motivation were comparable.

When focusing on studies with low motivation, the Information Protocol effect remained unvaried, in that it had an effect for the total frequency of verifiable details (Information Protocol present, $g = 0.80$; Information Protocol absent, $g = 0.17$), but not for the ratio of verifiable details nor for unverifiable details. It was not possible to explore the Information Protocol by motivation interaction further as there were no studies that employed an Information Protocol that had medium motivation.

Discussion

The present meta-analysis showed significant effects for the Verifiability Approach (VA) in discriminating truth tellers from liars. The effect sizes for the frequency of Verifiable Details ($g = 0.42$) and that for the Ratio of Verifiable Details ($g = 0.49$) were comparable and both moderate supporting the VA predictions that truth tellers report more Verifiable Details than liars and obtain a higher Ratio of Verifiable Details than liars. Sensitivity analyses showed that the effect for the total frequency of Verifiable Details and that for its ratio were quite stable. Unverifiable details could not discriminate between truth tellers and liars ($g = -0.25$).

We found high heterogeneity between the studies. This should not be surprising as the studies differed in several methodological aspects from each other, such as the implementation of

the Information Protocol, the nature of the statements, the medium by which the information was provided and participants' motivation. The moderator Information Protocol only influenced the total frequency of Verifiable Details effect. The effect size was small (g = 0.29) in the Information Protocol-absent condition but high (d = 0.80) in the Information Protocol-present condition. As Nahari (2018, 2019) reported, informing interviewees that their statements will be assessed for their verifiability gives truth tellers the possibility to think of (and add) further Verifiable Details. Because liars cannot provide Verifiable Details, the Information Protocol puts them in a difficult position. If they do not add Verifiable Details, they may not be believed during the interview. If they add false Verifiable Details, they may make an honest impression during the interview, but their lies will be discovered when the investigator will check the (false) Verifiable Details provided. Either way, they will fail to convince investigators that they are truthful.

We also found a significant moderating effect related to the frequency of Verifiable Details for the nature of the statements. The effect sizes differed significantly from zero only for event-related settings. When interviewees discuss an event (e.g., describing their whereabouts at the time of the crime), truth tellers can often use external sources to back-up their statements. Liars have fewer degrees of freedom because providing false Verifiable Details increases their risk of being caught out when investigators check these details. The situation for non-event settings is different. Malingering, for example, is based on symptoms like pain, fear, or fatigue, which are subjective and thus cannot be documented or observed (Nahari, 2019). Hence, truth tellers cannot back up their statements with external sources whereas liars have more degrees of freedom to provide false details about their symptoms as those cannot be verified.

When focusing on the Ratio of Verifiable Details, we found a moderating effect for the medium by which the statements were provided. The effect size was smaller for oral statements (g = 0.23) than for written statements (g = 0.58). This suggests that it may be more effective to ask interviewees to provide a written statement than an oral statement when examining the ratio of verifiable details/total details. Future research should explore the reason for this effect.

Regarding unverifiable details, we did not find a difference between truth tellers and liars. This variable should thus not be used to make veracity assessments. We do not consider this a loss or weakness of the VA because there is no theoretical rationale available to predict such a difference.

The global effect sizes for both the total frequency of Verifiable Details and their ratio were comparable to those of a previous meta-analysis in which total details was the dependent variable

(Amado, Arce, Farina, & Vilarino, 2016, *d* = 0.55). However, when the Information Protocol was introduced, the effect sizes of the VA for Verifiable Details was larger than the total details effect in Amado et al. (2016). Further, the VA is less sensitive to countermeasures than other verbal content approaches that do not account for the verifiability of details (Caso, Vrij, Mann, & De Leo, 2006; Vrij, Kneller, & Mann, 2000). One other veracity assessment tool that focuses on evidence is the Strategic Use of Evidence (SUE, Granhag & Hartwig, 2015). Core of SUE is that revealing evidence strategically to interviewees may result in statements-evidence inconsistencies. A meta-analysis showed large differences between truth tellers and liars in statement-evidence inconsistencies (*d* = 1.89) (Hartwig, Granhag, & Luke, 2014), which make it superior on the VA in terms of effect size. Whilst the SUE method is arguably also the easiest veracity assessment method to apply when investigators have evidence in hand, a significant advantage of the VA is that it also often can be applied in situations when investigators have no evidence and should decipher solely from the speech content whether a statement is true or false.

Practical utility of the findings

The present meta-analysis shows that the effect of the VA is stable across laboratory studies, with moderate effect sizes for both the total frequency of Verifiable Details and their ratio. However, before any claims are made about external validity and the applicability to real life scenarios, further research is needed. The findings reveal that the VA becomes more effective when an Information Protocol is used. This supports the recommendation to incorporate the Information Protocol as an integral component of the VA application (Nahari, 2018; Nahari, Vrij, et al., 2014b). The results on the efficacy of the Information Protocol also suggest that future efforts should be made to develop an effective and standardised Information Protocol. Further, if the VA would be used in real life, investigators should be properly trained how to use it. The training required is less extensive to that of other verbal lie detection techniques such as Criteria-Based Content Analysis and Reality Monitoring, or for training in psychophysiological detection of deception (e.g. the polygraph).

Limitations

Some limitations merit attention. First, almost all the studies came from the same scholars. Although we do not see any reasons why the approach should not work in other labs, replications by other researchers are essential. Second, the number of studies was limited, hence further studies and meta-analyses should be conducted to examine if our conclusions remain valid. Third, all experiments included in the meta-analysis were laboratory experiments. There is a need to explore

the efficacy of the VA in real life, for example by analysing statements from real-life situations. However, ground truth would be needed, which is difficult to obtain. Fourth, the meta-analysis only focused on the original VA working definition, in which the number of Verifiable Details is counted. Yet, there are also successful attempts to count verifiable sources rather than Verifiable Details (Vrij et al., 2019). Counting verifiable sources is easier and quicker than counting Verifiable Details, thus studies should further examine this type of coding. Fifth, our study was not pre-registered. We made our work method how to conduct the meta-analysis as transparent as possible but pre-registering this method would have been better. Sixth, we only included published studies for the reasons reported in the inclusion criteria section which, as said above, may result in an overestimation of the true effect size. Finally, the number of participants in the included studies was typically small, which also enhances the risk of an overestimation of the true effect size. Future VA studies therefore would benefit from larger samples.

Conclusion

In conclusion, the results of this meta-analysis suggest that the VA may be an effective tool for lie detection purposes when participants discuss events (e.g. whereabouts at the time of a crime, insurance claim), but not when they discuss non-events (e.g. malingering cases). In addition, the results show that the VA is particularly effective when the Information Protocol is introduced.

Author contributions

NP and LC conceived the meta-analysis, conducted the data analysis, interpreted the results, and wrote the first draft of the manuscript. AV and GN, contributed to the data analysis, the interpretation of the results, writing up the manuscript, and provided feedback. All authors agreed on the final version of the manuscript.

The authors declare no conflict of interest.

Acknowledgments

All data used in the present meta-analysis have been obtained from original studies and different sources. Requests from qualified researchers to access the coded variables derived from such original studies and used in the present manuscript may be sent to the corresponding author.

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Endnotes

1 In Nahari et al. (2014a) the ratio was verifiable details/unverifiable details. However, raw data were obtained, and the ratio verifiable/details total details calculated.

2 For PsycInfo and PsycArticles the search terms were searched through the paper.

3 There were three effect sizes explored: total frequency of verifiable details, total frequency of unverifiable details and ratio of verifiable details. The first two are independent from each other. The ratio is defined as verifiable details/(verifiable + unverifiable details) and thus related to the verifiable and unverifiable details variables. Separate analyses were conducted for each of the three measures, as collapsing them into a unique effect size would be statistically inappropriate.

4 A model statement is a detailed example of a truthful account concerning an event that is unrelated to the topic under investigation, which is used to provide the interviewee with an example of how much detail is expected from him/her. For a detailed overview see Aldert Vrij, Leal, and Fisher (2018).

5 Coached liars were instructed to use embedded lies, that is they were instructed to recall a past truthful experience and report it as current experience.

6 According to Higgins et al. (2011) random sequence generation refers to measure taken to allocate participants to the several condition randomly to obtain comparable groups.

Table 1. *Summary of the meta-analysis findings.*

Measure type	*k*	*g*	95% CI	Q_T	I^2
Frequency of Verifiable Details	20	0.42***	[0.25, 0.59]	49.83***	61.87
Ratio of Verifiable Details	18	0.49***	[0.29, 0.70]	55.46***	69.35
Frequency of unverifiable details[a]	15	-0.25	[-0.63, 0.13]	129.65***	89.20
Frequency of unverifiable details[b]	13	-0.02	[-0.35, 0.31]	80.78***	85.14

Note. A positive *d* indicates that truth tellers reported more (or a higher ratio of) verifiable details than liars. CI = confidence interval. Q_T = total heterogeneity. * $p < .05$. *** $p < .001$. [a] results including the outlier study (Harvey, Vrij, Leal, et al., 2017); [b] results excluding the outlier study.

Table 2. *Moderator analyses – frequency of verifiable details*

Variable	Q_B	*k*	*g*	95% CI	Q_W
Information Protocol	5.05*				
No		13	0.29**	[0.12, 0.46]	23.45*
Yes		6	0.80***	[0.39, 1.21]	15.13*
Nature of the statement	11.73**				
Event-related		15	0.56***	[0.36, 0.76]	38.75***
Non-event		5	0.08	[-0.11, 0.26]	1.65
Medium	1.81				
Oral statements		6	0.28**	[0.08, 0.48]	9.09
Written statements		14	0.50***	[0.26, 0.74]	38.76***
Motivation	0.35				
Low		12	0.47***	[0.23, 0.71]	33.30***
Medium		8	0.37**	[0.13, 0.61]	16.43*

Note. A positive *g* indicates that truth tellers reported more verifiable details than liars. CI = confidence interval. Q_B = Heterogeneity between factors levels. Q_W = Heterogeneity within factors levels. * $p < .05$; ** $p < .01$; *** $p < .001$

Table 3. *Moderator analyses – ratio of verifiable details.*

Variable	Q_B	k	g	95% CI	Q_W
Information Protocol	2.29				
No		12	0.35***	[0.20, 0.49]	14.42
Yes		6	0.86**	[0.21, 1.50]	36.06***
Nature of the statement	0.21				
Event-related		14	0.53***	[0.28, 0.77]	45.96***
Non-event		4	0.41	[-0.01, 0.83]	9.51*
Medium	4.50*				
Oral statements		4	0.23**	[0.07, 0.39]	0.88
Written statements		14	0.58***	[0.30, 0.85]	49.11***
Motivation	0.36				
Low		11	0.54**	[0.22, 0.87]	44.08***
Medium		7	0.42***	[0.19, 0.65]	10.30

Note. A positive g indicates that truth tellers reported a higher ratio of verifiable details than liars. CI = confidence interval. Q_B = Heterogeneity between factors levels. Q_W = Heterogeneity within factors levels. * $p < .05$; ** $p < .01$; *** $p < .001$

Table 4. *Moderator analyses – frequency of unverifiable details.*

Variable	Q_B	k	g	95% CI	Q_W
	Harvey, Vrij, Leal et al. (2017) excluded				
Information Protocol	0.29				
No		9	-0.17	[-0.47, 0.13]	30.17***
Yes		3	0.11	[-0.86, 1.08]	20.30***
Nature of the statement	2.71				
Event-related		8	0.19	[-0.27, 0.64]	55.06***
Non-event		5	-0.34	[-0.76, 0.09]	16.31**
Medium	2.41				
Oral statements		3	0.36	[-0.17, 0.89]	10.25**
Written statements		10	-0.15	[-0.51, 0.21]	50.18***
Motivation	0.07				
Low		8	0.01	[-0.37, 0.39]	40.89***
Medium		5	-0.10	[-0.77, 0.57]	36.55***
	Harvey, Vrij, Leal et al. (2017) included				
Information Protocol	0.84				
No		9	-0.17	[-0.47, 0.13]	30.17***
Yes		5	-0.68	[-1.74, 0.37]	63.77***
Nature of the statement	0.15				

Event-related		10	-0.20	[-0. 75, 0.34]	110.11***
Non-event		5	-0.34	[-0.76, 0.09]	16.31**
Medium	5.02*				
Oral statements		3	0.36	[-0.17, 0.89]	10.25**
Written statements		12	-0.41	[-0.83, 0.01]	89.32***
Motivation	0.30				
Low		10	-0.33	[-0.79, 0.14]	84.37***
Medium		5	-0.10	[-0.77, 0.57]	36.55***

Note. A positive *g* indicates that truth tellers reported a higher ratio of verifiable details than liars. CI = confidence interval

APPENDIX A – EXCLUDED SOURCES WITH REASONS

Source	Reason
Alper (2019)	The paper did not focus on the verifiability approach.
Deeb et al. (2018)	The paper did not focus on the verifiability approach.
Leal et al. (2018)	Verifiable sources instead of verifiable details were coded
Masip (2017)	The paper did not focus on the verifiability approach.
Nahari et al. (2019)	The paper was theoretical rather than empirical
Nahari and Nisin (2019)	The paper was theoretical rather than empirical
Nahari and Vrij (2014)	The paper focused on pairs of interviewees rather than individuals
Nahari and Vrij (2015)	The paper focused on liars only
Nieuwkamp, Horselenberg, and van Koppen (2018)	The paper did not focus on the verifiability approach.
Vrij (2016)	The paper did not focus on the verifiability approach.
Vrij (2018)	The paper did not focus on the verifiability approach.
Vrij and Fisher (2016)	The paper did not focus on the verifiability approach.
Vrij, Leal, and Fisher (2018)	The paper did not focus on the verifiability approach.
Vrij et al. (2017)	The paper did not focus on the verifiability approach.
Vrij et al. (2019)	Verifiable sources instead of verifiable details were coded