VA META-ANALYSIS AND DECLINE EFFECT

The Verifiability Approach: A Meta-Analysis of Published Studies and a Test of a Decline Effect

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Abstract

Liars are caught in a paradox: they want to provide details to be credible but not so many they could be discovered being untruthful. The verifiability approach assumes that liars include fewer verifiable details, more unverifiable details (or a similar amount), and a lower proportion of verifiable details than truth-tellers. This meta-analysis included 17 published studies, resulting in an overall medium veracity effect for the number ($g_u = 0.64$, $g_u = 0.55$ without outlier) and the proportion of verifiable details ($g_u = 0.66$). No veracity effect was found for the unverifiable details. The type of lie, the use of an information protocol, and the type of statement moderated the veracity effect on the verifiability approach. No effect was found for motivation. A decline effect only appeared for the number of verifiable details. Recommendations for future studies and field applications are discussed.

Keywords: deception, verifiability approach, meta-analysis, decline effect

Word count: 8500

The Verifiability Approach: A Meta-Analysis of Published Studies and a Test of a Decline Effect

According to DePaulo (1988), the economic theory of information posits that the verifiability of a claim is an indicator of its truthfulness. If a claim is perceived as verifiable, it is considered more truthful than a less verifiable one. Furthermore, the perception of verifiability associated with a lie influences the behavior of liars (Donovan et al., 2003). That is, when a lie could be verified by others, liars adapted their behavior accordingly (Donovan et al., 2003; Guillory & Hancock, 2012; Van Swol & Braun, 2014). For instance, people were less likely to engage in deceptive behavior when the lies are verifiable (Donovan et al., 2003; Toma et al., 2008). The verifiability of the lie influences the verbose of the statement and the inclusion of details and increases the cognitive load during the construction of the lie (Hancock et al., 2007; Walczyk et al., 2014). The included information can be more precisely studied by looking at the nature of the details provided (Oberlader et al., 2016). One of these characteristics is the verifiable nature of the details (Sporer & Schwandt, 2006).

All liars face the verification of the information they provide (Guillory & Hancock, 2012). Liars, therefore, use strategies to withhold and elaborate (un)verifiable information during an interrogation (Sporer & Schwandt, 2006). Furthermore, liars include less verifiable information (e.g., abilities) and more unverifiable information (e.g., interests) when they lie, as noted in public rather than in private LinkedIn resumes (Guillory & Hancock, 2012). The perception of the verifiability of the lie modifies the self-presentation strategy and therefore the inclusion of verifiable details (Guillory &

Hancock, 2012).

The idea that the verifiable nature of information can be used to detect lies has grown in deception literature over the years (Guillory & Hancock, 2012; Nahari et al., 2014b; Sporer & Schwandt, 2006). Recently, this idea was more broadly structured and developed within the verifiability approach (VA) framework.

The Verifiability Approach

According to the four-factor theory, liars monitor their behavior by controlling what they say and how they behave when they are deceiving (Zuckerman et al., 1981). During this self-presentation strategy, liars are caught in a paradox (Nahari, 2018). On the one hand, they want to give sufficient detail to sound credible because they do not take their credibility for granted (Nahari, 2018). They do so because a common belief associates a lack of detail with deceit; thus, liars do the opposite to appear honest (Vrij, 2008; Vrij & Nahari, 2019). On the other hand, they avoid providing too much detail in an effort to limit contradictions and not be discovered lying (Masip & Herrero, 2013; Nahari, 2018).

One way to manage this paradox is to give numerous unverifiable details and avoid giving verifiable ones (Nahari, 2018). Vrij and Nahari (2019) considered details to be verifiable when they belong to one of these categories: (a) activities with an identifiable or named person who can be consulted by the interviewers, (b) activities that have been witnessed by a person who can be consulted by the interviewers, (c) activities that the interviewees believed to be recorded on CCTV, and (d) activities that may have

been documented or recorded by any digital activities (e.g., phone calls). All details not belonging to one of these categories are considered unverifiable (Vrij & Nahari, 2019).

According to the VA framework, the veracity of a statement changes the inclusion of (un)verifiable details (Nahari, 2018). Liars include fewer and a lower proportion¹ of verifiable details than truth-tellers (Vrij & Nahari, 2019). Nonetheless, regarding the number of unverifiable details, the framework leads to two assumptions depending on the liar's motivation. Motivated liars provide more unverifiable details, whereas those that are not motivated provide a similar amount as truth-tellers (Vrij & Nahari, 2019). The motivation can be therefore be considered as a moderator of the veracity effect.

Moderators. The inclusion of (un)verifiable details in statements are influenced by the following features: (a) the possibility of truth-tellers to provide verifiable information whereas liars cannot (Vrij & Nahari, 2019), (b) the liars' monitoring of behaviors to appear credible (Zuckerman et al., 1981), and (c) the liars' perception of the lie verifiability (Guillory & Hancock, 2012). The latter feature influences the inclusion of (un)verifiable details through the liars' self-monitoring (Guillory & Hancock, 2012). However, we distinguished it since it can be a specific explanatory factor of liar's behavior for the inclusion of (un)verifiable information. These features can be addressed through different moderators. The truth-tellers' possibility and the liars' foresight of verification can be addressed through the type of lie and the use of an information protocol. Concerning the overall monitoring of behavior, two moderators are addressed in

¹The proportion of verifiable details is the number of verifiable details divided by the sum of the number of verifiable and unverifiable details (Vrij & Nahari, 2019).

the VA literature: the level of motivation and the type of statement.

Type of lies. Lies can involve external information (i.e., that could be verified by external criteria) or internal information (e.g., opinions; Boskovic et al., 2018; B. M. DePaulo & Rosenthal, 1979). On the one hand, the lies containing more external information allow truth-tellers to provide more verifiable details than internal ones. On the other hand, external lies reduce the willingness of liars to include verifiable details since they should perceived them as more verifiable than internal ones. For those reasons, the type of lie should moderate the veracity effect.

Information protocol. Over the years, the deception literature moved from looking for specific deception cues to ways of questioning to facilitate its detection (Vrij, 2015). Thus, greater focus was placed on strategic questioning or elicitation leading to better detection rates than on cue observation (Levine, 2015). The idea of developing strategic questioning in connection with the VA framework led to the information protocol (IP).

The IP defines what is considered verifiable information and informs the interviewee of the importance of including such information in their statements (Harvey et al., 2018). The IP was standardized into a grid (see Appendix A for the IP used by Harvey et al., 2018). Therefore, the use of an IP gives truth-tellers the opportunity to provide additional checkable content and increases the perception of lie verifiability for liars, resulting in greater reluctance to create verifiable content (Nahari et al., 2014a). Thus, truth-tellers will provide more verifiable details, whereas liars will not be able to do so (Nahari et al., 2014a). The use of an IP should be a moderator of the veracity effect on the VA.

Motivation. The motivation to succeed in telling a lie increases self-monitoring, resulting in greater control of what is said by the liars (DePaulo et al., 2003). Moreover, the differences between liars and truth-tellers are greater when there was an incentive to tell a lie (DePaulo et al., 2003; Zuckerman et al., 1981). Due to the self-regulation of the behaviors, the motivation to succeed in telling a lie should moderate the veracity effect on the VA.

Type of statements. The medium of a statement influences the production of deception cues (Elntib et al., 2015; Sporer, 2016). One can change the form and the content of written declarations, which is not possible with an oral statement. Therefore, each word, sentence, or detail provided and their consequences can be deliberated by the liars during a written statement (Sporer, 2016). It follows that liars are more self-aware of their behavior during a written statement compared with an oral one (Sporer, 2016). Since the type of statement leads to a different level of monitoring, medium is expected to moderate the veracity effect on the VA.

Decline Effect

Beyond psychological consideration, we wanted to test a decline effect. This phenomenon is the tendency of effect sizes to diminish over time (Levine, 2015). The decline effect has been observed in many research fields, such as medicine, neuroscience, and psychology (Clark et al., 2014; de Bruin & Della Sala, 2015; McMahon et al., 2008; Ozonoff, 2011; Schäfer & Schwarz, 2019). Deception researchers are also interested in this phenomenon (Bond et al., 2015; Levine, 2015; Luke, 2019). For instance, Bond et al. (2015) observed a decline effect for nonverbal cues, showing that they become weaker

over the years. Moreover, the more a cue was studied, the weaker the effect-size observed became (Bond et al., 2015). The presence of a decline effect in the deception field may be due to low powered studies and a selection of published studies (Luke, 2019). The rarely studied cues have a wide variation in the effect-size estimates (IntHout et al., 2015). On the other hand, although the most studied cues are more likely to approach the true effect, they are subject to publication bias and heterogeneity of the results (Luke, 2019).

No scientific consensus exists on the reasons for the presence of a decline effect (Bond et al., 2015). One of the explanations is the regression towards the mean phenomenon, which appears when a data has a more extreme value at its first measurement and then moves closer to the mean (Lehrer, 2010). Another explanation is the presence of a publication bias, which refers to the tendency of editors to publish strong effects first, followed by studies reporting weaker effects of the phenomenon (Lehrer, 2010; Schooler, 2011). Another reason is that over time researchers tested new variables and settings, and these investigations may have led to weaker or no effects (Lehrer, 2010; Schooler, 2011). Further, the evolution of beliefs over time was also mentioned to explain the variation in effect-size estimates (Stephens, 2016). Finally, the presence of a decline effect does not mean that an effect does not exist (de Bruin & Della Sala, 2015). Rather, it shows that the effect changes over time and that initially strong findings are challenged by subsequent studies (de Bruin & Della Sala, 2015). In the current work, we studied the decline effect of the main VA measurements.

Method

Research Question and Measures

The current meta-analysis aimed to study the use of the VA for lie detection. The predictor was veracity (truth, lie), and the VA framework was addressed through three measures: (a) the number of verifiable details, (b) the number of unverifiable details, and (c) the proportion of verifiable details. The latter corresponds to the number of verifiable details divided by the total number of details (i.e., the sum of verifiable and unverifiable details)². To present the methods and results of the current work, we followed the meta-analysis reporting standards as described by Cooper et al. (2009).

Inclusion and Exclusion Criteria

To be included in the meta-analysis, studies must meet all of the following

²No other proportion formula was considered, such as the verifiable/unverifiable details ratio used in the study of Nahari and Vrij (2014b).

criteria: (a) be published³ in a book chapter or in a peer-reviewed journal, (b) be an empirical study about the effects of veracity on the VA, (c) involve a between-veracity comparison (i.e., comparison of truth-tellers and liars), (d) have an independent dataset from the other studies, (e) include at least one of the three dependent measures of interest, (f) have manually coded data, and (g) have reported enough statistical data from which an effect size can be computed (i.e., by using one of the formulae described in Cooper et al., 2009). A list of the excluded references with the respective reasons for exclusion is available in Appendix B. The included references are listed in the Appendix C.

Moderator Analysis

Coding of study characteristics. The following information was coded for each study: (a) year of publication, (b) type of publication (book or journal), (c) sample size (number of truth-tellers, liars, males, females, and total sample), (d) age (mean and standard deviation), (e) type of settings (criminal, insurance, malingering, airport), and (f)

³ The grey literature (i.e., unpublished studies, conference proceedings, etc.) was excluded from the current meta-analysis, as it is not peer-reviewed. Numerous meta-analyses have been performed using only published studies (e.g., Atashili et al., 2008; Ibrahim and Al-Homaidh, 2011). Nonetheless, the exclusion of unpublished studies could lead, in our case, to overestimate the true average effect sizes of the veracity effect on the VA (Moher et al., 2000). For instance, meta-analyses limited to published trials in the field of health care intervention, compared with those that included both published and grey literature, overestimated the treatment effect from 9% to 15% (Auley, Tugwell & Moher, 2000; Hopewell, McDonald, Clarke, & Egger, 2007).

random assignment of participants in the truth-tellers and liars groups (yes or no⁴; see Appendix C).

Coding of the moderators. The following features were considered as potential moderators and coded as follows: (a) type of lie⁵ (external: criminal, insurance, and airport setting; internal: malingering setting), (b) use of an IP (no: participants were not informed that their statements will be verified; yes: participants were informed), (c) the motivation of participants to lie successfully (none: no motivation; low to medium: any financial benefit or compensation [e.g., credit course]; high: crime; we used the same criteria as Hauch et al., 2016), and (d) the type of statement (written or oral; see Appendix C).

Literature Search

Several steps were taken to complete a thorough citation search of published publications related to the VA and deception. First, we looked for VA publications in the two following reviews about the VA framework: (a) Nahari (2018) and (b) Vrij and Nahari (2019). Second, we completed this first step by a search in a citations database with keywords related to our topic. Several databases (PsycArticles, PsycInfo, Web of

⁴The no category also included the pseudo random assignment of participants in the truth-tellers and liars groups. For instance, in the study of Boskovic et al. (2017), the assignment of participants was based on the presence of symptoms.

⁵Concerning the type of lie, we did not test this moderator with the type of settings (a) for theoretical reasons highlighted in the introduction and (b) to not over-fit the moderator's analysis (there are many settings compared to the number of studies).

Science, and Google Scholar) were used as sources of citations. We searched the databases using the following keywords: “verifiability approach”; “verifiability approach” AND “deception”; “verifiability approach” AND “lie”. To identify publications of interest, we looked at the abstracts of the articles included in the database results. A final search was conducted in April 2020. Third, the first and the last author of this study examined the publications related to the VA framework for each identified reference, and likewise for the references found.

Coders. The first and the last author of this study established the coding scheme and coded the data. To ensure the accuracy and consistency of the coding, we followed a simplified Stock’s training process (Cooper et al., 2009) and proceeded as follows. First, the first author started by giving an overview of the work. This included definitions of coding items and description of the use of the coding scheme. Second, the coding scheme was tested on two studies and adjusted if necessary. Third, the two coders coded separately all features from all studies into two spreadsheets. Fourth, data were compared and potential disagreements were discussed until an agreement was reached between the two coders. An agreement was defined by having coded the same value in cell (e.g., “criminal” for the type of lie). The coding scheme was iteratively revised, as necessary.

Coding reliability. All data were double coded by the first and the last authors. Moreover, Kappa coefficients were computed for the categorical moderator variables, which ranged from .73 to .94 and indicate strong intercoder agreement (Landis & Koch, 1977).

Furthermore, Vrij and Nahari (2019) and Bogaard and colleagues (2020) reviewed

some of the VA publications and classified them according to the type of settings and the use of an IP. We cross-checked our coding with those reviews. Kappa coefficients indicate strong agreement, ranging between 1.00 and .94, for the type of settings and the IP (Landis & Koch, 1977).

Coding Procedure

Effect-size estimates. Cohen's d effect sizes were computed to allow for calculation of the unbiased effect-size estimate, g_u (Cooper et al., 2009). When the data were appropriate, we used the means, standard deviations, and sample sizes to compute the corresponding Cohen's d . Otherwise, we used other statistical measures, such as the test value (e.g., F distribution), and the corresponding formulae from Cooper and colleagues (2009). In the case where a group comparison was reported as nonsignificant, such as in Hauch et al. (2016), an effect size of 0 was assumed.

As stated in the criteria inclusion section, studies using a within-participants setting were not considered in the current work. The reason is that the computation of the within-participants effect size can be done only with data correlation matrices (Cooper et al., 2009). However, those matrices are never provided in the studies.

Dependent effect sizes. Meta-analyses are based on the prerequisite that effect-size estimates are based on independent data (Cooper et al., 2009). Nevertheless, the dependence on effect size may arise when multiple experimental groups are compared to the same control group (Cooper et al., 2009). For instance, in our case, if different groups of liars were compared to the same truth-tellers group. When this situation arose, we

averaged the means, we pooled standard deviations, and summed the samples to create only one group of comparison. This allowed the calculation of independent effect-size estimates.

Statistical Methods

Outliers. Before the integration of effect sizes in meta-analysis statistical analyses, we tested the presence of outliers. First, we conducted a visual inspection of the effect-sizes distribution and their confidence intervals with the weighted average effect sizes (Viechtbauer & Cheung, 2010). Second, we visualized the shape of the effect-sizes distribution by using a stem-and-leaf plot (Cooper et al., 2009). Third, we identified outliers' values using box plots with all the effect sizes. A study was considered as an outlier when its value was located at a distance of more than one and a half times the interquartile range (Cooper et al., 2009). If the three methods described pointed to the same value, we looked at the heterogeneity variation with and without the identified value. The withdrawal of an outlier from the model should reduce the model's heterogeneity. If this was the case, the value was therefore considered as an outlier in the subsequent analyses. Then, we computed the meta-analytic statistical analyses with and without the identified outlier(s).

Statistical model. We applied random-effect models because identified factors may be moderators of veracity effect on the VA (Cooper et al., 2009). Furthermore, the weighted average effect size was calculated by weighting each individual effect size (g_u) by the inverse of its variance (Cooper et al., 2009; Grasman & Others, 2017).

Heterogeneity. Heterogeneity in effect-size estimates was assessed through Cochran's Q and the I^2 index (Cooper et al., 2009). The I^2 index expresses the percentage of observed variance due to the real differences of studies between them (not just sampling error) and could, therefore, be explained by moderators. An I^2 value of 25% indicates small heterogeneity, one of 50% indicates medium heterogeneity, and one of 75% large heterogeneity (Hauch et al., 2016).

Programs and software. Data coding and transcription were conducted using spreadsheets. The computation of effect sizes, variances, and standard errors was performed using Python 3. Formulae were retrieved from Cooper and colleagues (2009), and we cross-checked 20% of our data with Wilson's calculator, resulting in similar values. The statistical meta-analyses indices were computed with JASP Team (2019; <https://jasp-stats.org>; version 0.11.1) computer software by using the Hedges random-effect models function (Grasman, 2017; Team & Others, 2018). The graphs were generated using both JASP and Python 3.

Results

Citations Examined

The literature search led to the identification of 25 publications. Twenty-one documents were journal publications and four were book chapters. Among those publications, 15 met our inclusion criteria and were considered in the final sample of the meta-analysis. Those publications result in 17 studies (two publications had two studies; see Appendix C). Ten studies were relevant on many but not all inclusion criteria and

were therefore excluded from the meta-analysis (see Appendix B).

Descriptive Data of Included Studies

The first article mentioning the VA was published in 2014, and the most recent article included in our sample was published in January 2020. On average, 2.42 studies ($SD = 1.72$) were published each year since 2014. Most of the included studies (73%) were conducted by the two VA leading researchers: one contributed to 93% of the studies and the second to 80%.

The 17 experiments included 1,657 participants with a weighted average age of 25.46 years ($SD_{\text{pooled}} = 5.68$). The assignment of participants to the veracity conditions was random in 41.20% of the studies. Eight experiments used a criminal setting (47.1%), whereas both the insurance and malingering settings were used in four experiments (23.5% each). Only one experiment was conducted in an airport (5.9%). Thus, this implies that 13 experiments (76.5%) used an external lie (i.e., criminal, insurance, or airport settings), and four (23.5%) used an internal one (i.e., a malingering setting). Nine studies included an IP (53.0%). The motivation was low in six studies (35.3%) and medium in 11 studies (64.7%). No study has been identified as having a high level of motivation. Finally, participants had to complete written statements in 12 studies (70.6%) and an oral statement in five (29.4%).

Meta-Analyses of Effect Sizes

This section deals with the overall effect of veracity on the VA (all potential moderators were considered in those analyses). Following Cohen's recommendation

(1988), an effect-size estimate of 0.20 was considered small, 0.50 as medium, and 0.80 as large. A positive value indicates that liars included fewer verifiable details than truth-tellers, and a negative value indicates that liars included more verifiable details than truth-tellers. Similar reasoning was followed for the two other measures.

Number of verifiable details. There was a significant effect of veracity for the number of verifiable details with a medium to large effect size, $g_u = 0.64$, 95% CI [0.36, 0.92]. Liars reported fewer verifiable details than truth-tellers. However, results were highly heterogeneous, $Q(14) = 61.18$, $p < .001$, $I^2 = 84.74$, 95% CI [65.32, 93.86], with g_u s ranging from -0.03 to 2.00 . One on the 15 effect sizes had a nonsignificant negative effect, nine had a significant positive effect, and five a nonsignificant positive effect (see Figure 1).

The analysis identified one outlier, the study of Nahari and Vrij (2014), $g_u = 2.00$, 95% CI [1.33, 2.67]. After removing that study, the heterogeneity decreased but still remained high, $Q(13) = 41.44$, $p < .001$; $I^2 = 75.19$, 95% CI [44.01, 90.63]. Without this outlier study, the weighted average effect size decreased, $g_u = 0.55$, 95% CI [0.32, 0.77], leading to a medium overall effect of veracity.

[Insert Figure 1]

Number of unverifiable details. No significant effect of veracity for the number

of unverifiable details was found, $g_u = -0.43$, 95% CI $[-0.98, 0.12]$ (see Figure 2). Thus, liars did not report more unverifiable details than truth-tellers. The distribution was highly heterogeneous, $Q(7) = 89.44$, $p < .001$; $I^2 = 91.01$, 95% CI $[79.75, 97.86]$. The g_u s ranged from -1.60 to 0.84 . Five of the eight effect sizes had a significant negative effect, two had a nonsignificant positive effect, and one had a significant positive effect. No outlier value was identified.

[Insert Figure 2]

Proportion of verifiable details. There was a significant effect of veracity for the proportion of verifiable details with a medium to large effect size, $g_u = 0.66$, 95% CI $[0.40, 0.92]$ (see Figure 3). Liars reported a lower proportion of verifiable details than truth-tellers. Again, the results were highly heterogeneous, $Q(11) = 52.19$, $p < .001$; $I^2 = 78.31$, 95% CI $[56.20, 92.82]$. The g_u s ranged from -0.08 to 1.35 . One of the 12 effect sizes had a nonsignificant negative effect, two had a nonsignificant positive effect, and nine had a significant positive effect. No outlier value was identified.

[Insert Figure 3]

Moderator Analyses

This section describes the potential moderators of the relationship between veracity and the VA: type of lies, use of an IP, motivation, and type of statements. Previous analyses showed that the distributions of effect sizes were highly heterogeneous. This indicates there is more than just sample error in the effect-size variations. Moderators could, therefore, account for partly or wholly the unexplained variance. The Table 1 shows the effect sizes and the results (Cochran's Q and I^2) for each moderator. The Table 2 shows the interrelations of the moderators.

The type of lies and the use of an IP moderated the veracity effect, but only for the number of verifiable details⁶. In both cases, liars included fewer verifiable details than truth-tellers. Nonetheless, the average effect sizes were larger for external lies and when an IP was used. The motivation did not moderate the veracity effect for the three measures. Finally, the type of statement moderated the veracity effect only for the number of unverifiable details. Liars included more unverifiable details in written statements, whereas they included less ones in oral statements. However, this must be considered with caution because only one study was available for this measure in the oral condition (see Table 1 for details).

⁶To simplify the current section, only the moderator analyses for the number of verifiable details without the identified outlier value has been commented on (i.e., Nahari & Vrij, 2014). Results with the outlier appear in Table 1.

[Insert Table 1]

[Insert Table 2]

Decline Effects

This last section deals with the test of the decline of the effect-size estimates over time for the three measurements. Linear regressions showed that there was a decline effect for the number of verifiable details⁷, since their effect sizes decrease over the years, $R^2 = .51$, $F(1, 13) = 13.43$, $MSE = 0.16$, $p = .003$. No decline effect was detected for the two other measures. The effect sizes for the number of unverifiable details remained constant over the years, $R^2 = .00$, $F(1, 6) < 1$, $MSE = 0.74$, *ns*. The effect sizes of the proportion of verifiable details remained constant over the years, $R^2 = .13$, $F(1, 10) = 1.49$, $MSE = 0.21$, $p = .250$. The Figure 4 shows the evolution of effect sizes over the years for the three measurements.

[Insert Figure 4]

⁷The analysis was performed with the outlier value.

Discussion

Overall, the meta-analysis findings support the main VA assumptions about the verifiable details but not about unverifiable ones (Vrij & Nahari, 2019). In accordance with the VA framework, liars included fewer verifiable details (medium effect size) and a lower proportion of verifiable details than truth-tellers in their statements (medium to large effect size; Vrij & Nahari, 2019). The effect was slightly higher for the proportion, supporting the idea that within-subject measures are more reliable (Vernham et al., 2020; Vrij et al., 2018).

Nevertheless, liars did not provide more unverifiable details than truth-tellers as it was expected (Vrij & Nahari, 2019). Overall the findings partially support the VA rationale proposed by Nahari (2018). Because they do not take their credibility for granted, liars want to give numerous details to sound credible in accordance with the common belief that a lack of detail is a signature of deception (Nahari, 2018). In fact, liars try to act the exact opposite to appear honest (Vrij & Nahari, 2019). But it was expected that they also avoid giving too many details to prevent contradictions (Nahari, 2018). And one way to manage this paradox is to give numerous unverifiable details and avoid giving verifiable ones (Nahari, 2018). However, the results did not show any increase in unverifiable details, meaning that liars seem unable to elaborate such details.

In line with the previous observations about deception cues (Luke, 2019), heterogeneity of the findings was high, due in part to the presence of moderators. For instance, the type of lie, the use of an IP, and the type of statement moderated the veracity effect on the VA. However, this was not the case for motivation.

The types of lies and the use of an IP were expected to moderate the veracity effect in the same way, since they share common theoretical rationales: the possibility of truth-tellers to provide more verifiable details, and the increase of lie verifiability for the liars. However, findings partially support those expectations. The types of lies and the use of an IP moderated the veracity effect on the VA only for the number of verifiable details. Indeed, liars included fewer verifiable details in lies relying on external information (e.g., activities; large effect size) compared to lies relying on internal information (e.g., symptoms; small effect size). Moreover, liars included fewer verifiable details than truth-tellers when a an IP was used (large effect size) compared to the lack of IP (medium effect size). However, the types of lies and the use of an IP did not moderate the veracity effect for both the unverifiable details and the proportion of verifiable details. A higher variation of the unverifiable effect sizes was evident for the external lie and the use of an IP, and fewer unverifiable details for the internal lies and when an IP was not used (see confidence intervals in Table 1).

Several explanations can be given. First, when lying about internal information or when an IP was not used, liars tried to take advantage of the situation, as they perceive their lies as less verifiable. Thus, they consistently gave many more unverifiable details than truth-tellers. Second, when they lie about external information or when an IP was used, it appeared that liars can provided more unverifiable details than truth-tellers (see the extreme values of the confidence intervals in Table 1), which would be in line with the assumptions that they perceived the lies as more verifiable (Guillory & Hancock, 2012). It also appeared that liars can give less unverifiable details since they are reluctant

to talk when they face a possible verification of their statements. In addition, to better understand the variation of unverifiable details, theoretical assumptions about truth-tellers need to be made.

The level of motivation and the type of statement, which should have influenced the inclusion of (un)verifiable details through self-presentation strategy did not, overall, moderated the veracity effect. Regarding the motivation to lie, the findings did not support the latest VA assumptions (Vrij & Nahari, 2019). This could be explained by the operationalisation of the motivation level. The low and medium levels of motivation may not have been different enough to observe an effect.

Concerning the type of statement, liars reported more unverifiable details in written statements than truth-tellers, in line with the self-presentation assumption (Nahari, 2018). However, this finding should be considered with caution, as only one study was available for this measurement in the oral condition. So, the effect of the medium on the verifiability should be deepened.

Decline Effect: Only for the Number of Verifiable Details

The decline effect is the tendency of effect sizes to diminish over time and has been previously observed on deception cues (Bond et al., 2015). Regarding the VA measurements, we found a decline effect for the number of verifiable details only. Hence, the effect sizes of the first studies appear to be inherently inflated for this measure (Ioannidis, 2008).

Although the current analysis does not allow us to address the reason for such a

decline, several reasons could be assumed. One relates to the phenomenon of regression towards the mean or the presence of publication bias because, in addition to a decline effect, one of the first VA studies published was identified as an outlier (i.e., Nahari & Vrij, 2014). Another explanation could be the variety of the settings studied over time. Indeed, the first studies focused on mock crime settings, and thereafter other settings were studied resulting in lower effect-size estimates (e.g., malingering). Nevertheless, to fully understand the source of a decline effect, all VA data should be available (for details see Protzco & Schooler, 2017).

Regarding the number of unverifiable details and the proportion of verifiable details, the evolution of their effect sizes did not show a decline effect. The findings differed from what was previously observed on deception cues (Luke, 2019). When there is no significant relationship between the year of publication and the effect sizes, it could be assumed that the synthesis provides a longitudinally stable measure (Stephens, 2016). However, the number of studies available is limited. These flat trends therefore question the sufficiency and the stability of the two measures (Mullen, Muellerleile, & Bryant, 2001). This could indicate the presence of an effect for the proportion, but an absence for the unverifiable details. Further studies are yet to be conducted to accumulate data.

Limitations and Guidelines for Further Studies

Although the effect sizes observed for the verifiable details are medium to large, the current meta-analysis has only focused on published studies. Thus, this could have resulted in an overestimation of the true veracity effect on the VA (9% to 15% more; Auley et al., 2000). The inclusion of unpublished should actually decrease the magnitude

of the observed effects, and consequently, the evidence concerning the VA relevance. More research is needed to still test the VA rationale. This can be done by (a) conducting replications of the VA studies (Bravers, Thoemmes, & Rosenthal, 2014; Schooler, 2014), (b) using open access repositories for all research findings, consistent or inconsistent with hypotheses (Schooler, 2011), and (c) systematically reporting the main VA measures (which was not always the case in available studies). Research on subcategories of verifiable details (e.g., checkable sources; Vrij et al., 2020) also needs to be deepened, as they can better address policing needs.

Within the VA framework, the amount of verifiable information is used to assess the veracity of a statement. Nevertheless, in studies, the truthfulness of information is never assessed. It is the verifiable nature of the reported information that is used to distinguish the lie from the truth and not the results of the verification (for details see Vrij & Nahari, 2019). In the field, investigators verify the information to test the veracity of the statements (Nahari, 2018). This is thus a different way of using the checkable information than what the VA offers. These two ways of using verifiable information lead to two potential applications of the VA, which should be considered according to their uses.

The VA findings were relevant in mock crime settings. Nonetheless, there is an underlying condition behind this: truth-tellers must have done verifiable activities. So, if truth-tellers have not carried out verifiable activities, then they will not be able to provide verifiable details. For instance, the *alone at home* alibi cannot be verified (Nahari & Vrij, 2014). If an investigator finds few verifiable details in a suspect's statement, this can lead

to two different conclusions about truthfulness: either a deceptive or a truthful statement. Hence, assessing credibility using the verifiable nature of information should be avoided to ensure justice.

Investigators are looking for information that can be verified. The VA findings showed that the use of an IP can help them collect more verifiable information to check afterward. Other ways of eliciting and gathering verifiable information must be developed and tested (Levine, 2014). Nonetheless, to be relevant, elicitation should be combined with the desire to increase the perception of the lie verifiability. For instance, the use of a model statement allows investigators to collect more information (Bogaard et al., 2020). Its use has been shown to increase the number of verifiable details for both liars and truth-tellers but did not allow to them to be sorted more easily (Bogaard et al., 2020; Vrij et al., 2020). This may indicate that using only elicitation methods may not be sufficient (Bogaard et al., 2020).

Strategic questioning could, therefore, focus on ways to increase the perception of the lie verifiability. Indeed, liars are both less likely to engage in lying and more reluctant to create verifiable details if they believe that the information can be verified. For instance, this could be addressed in several ways: (a) informing the interviewee about the public nature of the statements they will give based on the fact that liars include fewer verifiable details when their statements are public rather than private (Guillory & Hancock, 2012), (b) informing the interviewee about the interviewer's special expertise in a field of interest. For instance, in the case of a lie about an occupation (Jupe et al., 2016), an interviewer could be presented to an interviewee as having expert knowledge in that

area (i.e., perceived as being able to verify what is said), which would lead the liar to include fewer verifiable details compared to a situation when the interviewer is presented as naive (i.e., less able to verify), and (c) nurturing the idea that the interviewer knows more about the topic of the statement (i.e., using the knowing-it-all illusion method from the Scharff technique; May & Granhag, 2016). The latter should generate the idea that the interviewer will be able to check what is being said, leading to less verifiable statements from liars. In addition, increasing the perception of the lie verifiability should increase the cognitive load of the liars, which is helpful for lie detection (Cassidy et al., 2018; Vrij et al., 2017) and discouraging people from lying.

Conclusion

Practitioners would like to have an efficient lie detection tool, and the VA framework can suit police needs on the field. Nevertheless, more data are still needed to consider the VA as an evidence-based practice. First, because purpose of the VA is to make a decision about the veracity of a statement, its use in the field could present some deleterious aspects. Second, the decline effect observed on the verifiable details questions the utility of the method. Nonetheless, beyond the credibility assessment based on details verifiability, the use of strategic questioning should allow investigators to gather more verifiable information to verify afterward.

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Table 1*Moderator Analyses of the Veracity Effect on the Verifiability Approach*

Moderator	Parameter	Number of verifiable details (without outlier)	Number of verifiable details (with outlier)	Number of unverifiable details	Proportion of verifiable details
<i>Type of lie</i>					
	$Q_B(1)$	8.36**	6.75**	0.09	0.99
	$Q_w(df)$	31.54** (12)	48.90*** (13)	85.30*** (6)	51.68*** (10)
	I^2 [95% CI]	52.81 [19.06, 84.22]	76.07 [47.08, 90.94]	91.90 [80.82, 98.35]	77.41 [55.11, 93.01]
External	g_u [95% CI] (k)	0.75 [0.52, 0.98] (10)	0.87 [0.57, 1.17] (11)	-0.35 [-1.42, 0.71] (4)	0.80 [0.46, 1.13] (8)
Internal	g_u [95% CI] (k)	0.12 [0.01, 0.24] (4)	0.12 [0.01, 0.24] (4)	-0.53 [-1.04, -0.02] (4)	0.49 [0.09, 0.90] (4)
<i>Information Protocol</i>					
	$Q_B(1)$	5.40*	2.01	0.05	1.02
	$Q_w(df)$	37.23*** (14)	59.78*** (15)	38.39*** (5)	55.64*** (12)
	I^2 [95% CI]	67.51 [32.80, 87.54]	80.80 [60.30, 92.13]	86.63 [65.67, 97.80]	77.84 [56.45, 92.23]
Yes	g_u [95% CI] (k)	1.00 [0.60, 1.39] (6)	1.00 [0.60, 1.39] (6)	-0.74 [-2.42, 0.95] (2)	0.87 [0.36, 1.37] (5)
No	g_u [95% CI] (k)	0.45 [0.19, 0.70] (10)	0.59 [0.23, 0.95] (11)	-0.58 [-1.03, -0.14] (5)	0.57 [0.26, 0.88] (9)

(continued)

Table 1 (continued)

Moderator	Parameter	Number of verifiable details (without outlier)	Number of verifiable details (with outlier)	Number of unverifiable details	Proportion of verifiable details
<i>Motivation</i>					
	$Q_B(1)$	0.56	0.03	0.16	0.01
	$Q_W(df)$	39.81*** (12)	60.52*** (13)	76.45*** (6)	51.01*** (10)
	I^2 [95% CI]	74.83 [44.87, 91.03]	85.49 [66.82, 94.40]	91.79 [80.27, 98.32]	79.54 [57.92, 93.59]
Low	g_u [95% CI] (k)	0.70 [0.35, 1.06] (6)	0.70 [0.60, 1.39] (6)	-0.53 [-1.18, 0.13] (5)	0.69 [0.19, 1.18] (5)
Medium	g_u [95% CI] (k)	0.48 [0.19, 0.78] (8)	0.65 [0.23, 0.95] (9)	-0.31 [-1.47, 0.85] (3)	0.70 [0.39, 1.02] (7)
<i>Type of Statement</i>					
	$Q_B(1)$	2.07	1.99	4.76*	2.43
	$Q_W(df)$	31.92*** (12)	47.77*** (13)	38.94*** (6)	36.22*** (10)
	I^2 [95% CI]	70.76 [31.37, 89.39]	81.93 [57.55, 93.00]	84.92 [62.79, 96.93]	71.93 [43.36, 91.17]
Oral	g_u [95% CI] (k)	0.28 [0.25, 0.31] (3)	0.28 [0.25, 0.31] (3)	0.84 [-, -] (1)	0.27 [0.09, 0.45] (2)
Written	g_u [95% CI] (k)	0.66 [0.39, 0.93] (11)	0.77 [0.44, 1.10] (12)	-0.63 [-1.11, -0.14] (7)	0.78 [0.49, 1.07] (10)

Note. - = no value. k = number of independent samples.

* $p < .05$, ** $p < .01$, *** $p < .001$.

Table 2*Correlation Matrix (Phi index) of Moderators*

Moderator	Type of Lie	Information Protocol	Motivation	Type of Statement
Type of Lie	-	-.311	-.171	.358
Information Protocol		-	-.203	.167
Motivation			-	-.477*
Type of Statement				-

* $p < .05$, ** $p < .01$, *** $p < .001$.

Figure 1

Forest Plot of Effect Sizes (g_u) for the Number of Verifiable Details (with Outlier)

Note. The study of Nahari and Vrij (2014) was identified as an outlier. The black squares size depends on the sample size. The right column displays the effect sizes (g_u) and their respective 95% confidence interval in brackets. RE Model = random-effect model. The black diamond indicates the weighted average effect size and its 95% confidence interval.

Figure 2

Forest Plot of Effect Sizes (g_u) for the Number of Unverifiable Details

Note. The black squares size depends on the sample size. The right column displays the effect sizes (g_u) and their respective 95% confidence interval in brackets. RE Model = random-effect model. The black diamond indicates the weighted average effect size and its 95% confidence interval.

Figure 3

Forest Plot of Effect Sizes (g_u) for the Proportion of Verifiable Details

Note. The black squares size depends on the sample size. The right column displays the effect sizes (g_u) and their respective 95% confidence interval in brackets. RE Model = random-effect model. The black diamond indicates the weighted average effect size and its 95% confidence interval.

Figure 4

Evolution of Effect Sizes (g_u) over the Years for the Main Measures of the Verifiability Approach

Note. Panel A: Number of Verifiable Details. Panel B: Number of Unverifiable Details. Panel C: Proportion of Verifiable Details. R^2 = determination coefficient of the linear regression. The gray shadow indicates 95% confidence interval.

Appendix A

An Example of Information Protocol Instruction Used by Harvey et al. (2018)

We know from research that liars prefer to avoid providing details that can be verified whereas truth-tellers prefer to provide details that can be verified. Therefore, the analyst will check carefully to what extent the details you provide can be verified. Verifiable details are (i) activities carried out with identifiable or named persons who the interviewer can consult, (ii) activities that have been witnessed by identifiable or named persons who the interviewer can consult, (iii) activities that the interviewee believes may have been captured on CCTV, and (iv) activities that may have been recorded and documented, such as using debit cards, mobile phones, or computers. The analyst may check the occurrence of some or all of the details provided in your statements after the interview to ensure their authenticity. (Harvey et al., 2018, p. 804)

Appendix B

List of Excluded Papers and Their Respective Exclusion Reasons

Authors (Year)	Reason for exclusion
Nahari and Vrij (2015)	The study did not compare truth-tellers and liars but two crime scenarios.
Jupe, Vrij, Nahari, Leal, & Mann (2016)	The study had an intra-participant design.
Kleinberg, Mozes, Arntz, & Verschuere (2018)	The verifiable details were coded automatically by using name entities recognition.
Leal, Vrij, Vernham, Dalton, Jupe, Harvey, & Nahari (2018)	The study tested verifiable sources, which is a subcategory of verifiable details.
Nahari (2018)	The paper was not an experimental study.
Nahari (2019)	The paper was not an experimental study.
Nahari and Vrij (2019)	The paper was not an experimental study.
Vrij and Nahari (2019)	The paper was not an experimental study.
Bogaard, Meijer, & Van der Plas (2020)	The study had an intra-participant design.
Vrij, Leal, Deeb, Chan, Khader, Chai, & Chin (2020)	The study tested verifiable and digital sources, which are subcategories of verifiable details.

Appendix C

List of Included Studies and Their Respective Descriptive Data and Moderators

Authors (Year)	Descriptive Data									Moderators			
	n_{truth}	n_{liars}	n_{males}	n_{females}	N	M_{age}	SD_{age}	Random Assignment	Type of Setting	Type of Lie	Information Protocol	Motivation	Type of Statement
Nahari, Vrij & Fisher (2014b)	22	16	5	33	38	24.74	4.43	No	Criminal	External	No	Low	Written
Nahari and Vrij (2014)	25	25	(41)	(59)	50	(22.83)	(3.36)	Yes	Criminal	External	Yes	Medium	Written
Nahari, Leal, Vrij, Warmelink, & Vernham (2014)	41	42	22	61	83	25.31	8.4	No	Insurance	External	No	Medium	Oral
Nahari, Vrij & Fisher (2014a)	43	44	(35)	(53)	87	(24.10)	(3.21)	Yes	Criminal	External	Yes	Medium	Written
Vrij, Nahari, Isitt, & Leal (2016)	25	25	28	22	50	25.92	9.07	No	Insurance	External	Yes	Low	Written
Boskovic, Bogaard, Merckelbach, Vrij, & Hope (2017, Exp. 1)	41	84	17	108 [†]	125	20.00	2.48	No	Malingering	Internal	No	Low	Written
Boskovic, Bogaard, Merckelbach, Vrij, & Hope (2017, Exp. 2)	38	67	27	78 [†]	105	20.00	1.48	No	Malingering	Internal	Yes	Low	Written
Harvey, Vrij, Nahari, & Ludwig (2017)	40	40	22	58	80	21.36	4.13	No	Insurance	External	Yes	Low	Written
Harvey, Vrij, Leal, Lafferty, & Nahary (2017)	40	40	44	36	80	20.07	2.35	No	Insurance	External	Yes	Low	Written
Jupe, Leal, Vrij, & Nahari (2017)	204	195	270	117	399 [‡]	35.05	12.71	Yes	Airport	External	No	Medium	Oral
Harvey, Vrij, Sarikas, Leal, Jupe, & Nahari (2018, Exp. 1)	33 [§]	34 [§]	25	42	67	19.52	1.67	Yes	Criminal	External	Yes	Medium	Written
Harvey, Vrij, Sarikas, Leal, Jupe, & Nahari (2018, Exp. 2)	48	48	34	62	96	24.06	7.03	Yes	Criminal	External	Yes	Medium	Oral
Boskovic, Gallardo, Vrij, Hope, & Merckelbach (2019)	18	35	11	42	53	21.13	2.56	No	Malingering	Internal	No	Medium	Written
Boskovic, Dibbets, Bogaard, Hope, Jelicic, & Orthey (2019)	22	46	15	52 [†]	67	22.5	3.83	No	Malingering	Internal	No	Medium	Written
Jupe, Vrij, Leal, & Nahari (2020)	78	64	42	100	142	23.66	7.85	Yes	Criminal	External	Yes ^{††}	Medium	Oral

(continued)

Appendix C (continued)

Authors	Descriptive Data									Moderators			
	n_{truth}	n_{liars}	n_{males}	n_{females}	N	M_{age}	SD_{age}	Random Assignment	Setting	Type of Lie	Information Protocol	Motivation	Type of Statement
Verigin, Meijer, & Vrij (2020)	40	35	(19)	(92)	75	(21.91)	(4.25)	No	Criminal	External	No	Medium	Oral
Vernham, Vrij, Nahari, Leal, Mann, Satchell, & Orthey (2020)	30	29	(34)	(84)	59	24.38	10.48	Yes	Criminal	External	No	Medium	Written

Note. The values in parentheses () were reported as a general information about the overall sample of participants. These values were extracted from the published article but did not always correspond to the final subgroups sample size of truth-teller and/or liar group. N = overall sample size; n_{truth} = sample size of the truth-teller group; n_{liars} = sample size of the liar group.

[†] The value was computed from the parameters displayed in the study and rounded to the superior digit. [‡] The value is not equal to the sum of the n for *Gender* because this information was missing for 12 participants. [§] The values were reversed between the abstract and the manuscript. We therefore choose the values displayed in the procedure section of the manuscript (Harvey et al., 2018, p. 789). ^{**} Jupe et al's study (2020) was excluded from the IP moderator analysis. Although there was an IP manipulation, no available data allowed to compare the truth and the lie.