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RESEARCH ARTICLE

Is the uncertain self good at detecting lies? The influence of personal uncertainty on deception detection

Marc-André Reinhard[1] | Sarah Volz[1] | Kees van den Bos[2] | Patrick A. Müller[3]

[1]University of Kassel, Kassel, Germany

[2]Utrecht University, Utrecht, The Netherlands

[3]Hochschule für Technik Stuttgart, Stuttgart, Germany

Correspondence
Marc-Andre Reinhard, Department of Psychology-Social Psychology, University of Kassel, Holländische Str. 36–38, 34127 Kassel, Germany.
Email: reinhard@psychologie.uni-kassel.de

Homepage: https://www.uni-kassel.de/fb01/institute/institut-fuer-psychologie/fachgebiete/sozialpsychologie

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Abstract

Five experiments (total number of judging participants = 1309, four different kinds of stimulus materials with a total of 464 messages, total number of judgements = 19,634) investigated the influence of personal uncertainty on the process of lie detection in social relationships. Building on and extending basic assumptions of uncertainty management models, we reasoned that uncertainty about themselves motivates people to evaluate the quality of their relationships. A crucial aspect of the quality of relationships with other people is the truthfulness with which they communicate verbally with you and anyone else. We proposed that if these assumptions are valid, reminding people of their personal uncertainties should lead them to use valid verbal cues in veracity judgements more. This enhanced usage of valid verbal cues should result in better accuracy in deception detection. An internal meta-analysis of the five experiments reveals only a small, not significant, overall effect of uncertainty salience on detection accuracy with larger effect sizes for experiments conducted in the laboratory than for those conducted online. Hence, if personal uncertainty plays a role in the process of deception detection, it seems to be subject to moderators such as methodological or motivational factors.

KEYWORDS
judgementdetection of deception, lay judgement, lie detection, relationship quality, uncertainty, verbal communication

1 | INTRODUCTION

The ability to detect whether others lie to us or tell us the truth is of great importance to humans in many social settings (Bond & DePaulo, 2006; Ekman, 2001). For example, to determine whether it is safe to cooperate with another individual or a group, it is essential to determine whether we can trust somebody (Tooby & Cosmides, 1996). Furthermore, an individual who discovers that an interaction partner is lying can infer from this observation that the general quality of their interrelationship is low; after all, people tell fewer lies to others they are close to (DePaulo & Kashy, 1998). The present investigation tested whether personal uncertainty improves the accuracy of people's judgements about whether others are being truthful or lying as a way to assess whether they are being treated fairly.

1.1 | Personal uncertainty as a motivator for assessing social relations

People can encounter many different types of uncertainties (Van den Bos & Lind, 2002). One special type of uncertainty is personal uncertainty, which typically is defined as a subjective sense of doubt or instability in self-views, world-views, or the interrelation between the two (Arkin, Oleson, & Carroll, 2009). The presumed importance of uncertainty for social judgements lies in the fact that people dislike uncertainty. There are some exceptions to this rule (see, e.g., Weary & Jacobson, 1997; Wilson et al., 2005), but these *are* exceptions and on close inspection mainly have to do with missing information (i.e., informational uncertainty, such as missing information about outcomes to be received) and not with the experience of feeling uncertain about yourself (i.e., personal uncertainty; see Van den Bos, 2009). In general, individuals find *personal* uncertainty an uncomfortable or aversive event (Hogg, 2007; Van den Bos, 2009) and therefore try to reduce or resolve this disliked state most of the time. The uncertainty management model (UMM; Van den Bos & Lind, 2002) states that social integration is one way to cope with this uncertainty (see also Hogg, 2007). It is thus assumed that when people are uncertain about themselves or when personal uncertainty is salient, they are more sensitive to cues that inform them about their integration into relevant social groups and relationships (Hogg, 2007; Van den Bos, 2009).

1.2 | Lies as cues for social relations

Research testing the UMM has focused on essential cues of social integration, such as group identification (see Hogg, 2007), cultural world-views (see Van den Bos et al., 2005), or judgements about the fairness of treatment and outcome distributions (see Van den Bos & Lind, 2002). Fair treatment, for example, offers the maximum chance of a deserved outcome and signals that the group or organization values the individual as a member (e.g., Lind & Tyler, 1988). Van den Bos (2001) found that individuals to whom personal uncertainty was made salient showed stronger reactions towards being granted an opportunity to voice their opinions in a distribution process. This sensitizing role of uncertainty can be seen as a reaction to individuals' motivation to understand the quality of their social relationships in such circumstances. Corroborating this view, Janssen et al. (2011) found that personal uncertainty motivates individuals to form these judgements more deliberately and take fewer heuristic cues into account. The current article seeks to extend the basic assumptions of the UMM to another very important cue that signals social integration and quality of exchange relationships. Specifically, we focus on veracity judgements because somebody telling us the truth or a lie about something strongly indicates that person's intentions towards us (DePaulo & Kashy, 1998).

1.3 | Information processing under uncertainty

Using the UMM, we argue that people under uncertainty should be more motivated to determine the veracity of a statement because they are trying to assess the quality of social relationships, which is especially important under uncertainty (e.g., Van den Bos & Lind, 2002). We assume that this increased motivation to determine the veracity of a statement leads to a more thorough elaboration of a message's content.

Uncertainty has been found to affect information processing (e.g., Janssen et al., 2011; Tiedens & Linton, 2001). Individuals under uncertainty were equally easily persuaded by a message regardless of the sender. Individuals under certainty were persuaded more efficiently when the message was presented by someone stereotypically connected to high expertise (Experiment 2; Tiedens & Linton, 2001). In a field study, Janssen et al. (2011) found that applicants experienced with application procedures relied on heuristic, salient cues when they felt certain. Experienced applicants who felt uncertain and inexperienced applicants regardless of their level of certainty based their judgements more on content information. For both studies, the authors concluded that the results were due to the heuristic use of information when being certain and the engagement of systematic processing under uncertainty.

1.4 | Increased motivation to detect deception under uncertainty

Increased motivation to determine a message's veracity under uncertainty should increase motivation to elaborate a message's content rather than using stereotypical information. The stereotype that lying is associated with an increase in the non-verbal behaviour of the body and extremities is not supported by research studying actual indicators of deception. The meta-analyses by DePaulo et al. (2003) and Sporer and Schwandt (2007) found no evidence or only minor evidence that liars show more posture shifts, head movements, and hand, arm, or foot movements than truth-tellers. Also, the widespread belief that liars display less eye contact (i.e., gaze aversion) than truth-tellers (Global Deception Research Team, 2006) is not supported by empirical data (DePaulo et al., 2003).

However, for verbal cues, which are more challenging to process and therefore require more motivation, beliefs about deception cues are more consistent with actual cues to deception; increased use of verbal cues under uncertainty should consequently be associated with higher accuracy. Many studies found that people expect that lies are discrepant, ambivalent, less plausible, and contain fewer details than the truth (e.g., Global Deception Research Team, 2006). For example, in a worldwide survey study, the Global Deception Research Team (2006) identified incoherence and inconsistency as two of the most common beliefs about deception. Reinhard et al. (2002) showed that participants who assessed the veracity of other people's statements listed logical consistency (i.e., perceived plausibility) and the number of details among the most important reasons why they thought a given statement was truthful. The verbal cues believed to be associated with deception were also somewhat related to actual deception. DePaulo et al. (2003) found that lies made less sense than truths: they were less plausible, less logically structured, more discrepant and more ambivalent. DePaulo et al. also found that lies contained fewer details than truths.

Supporting this line of argument, the results of a meta-analysis by Bond and DePaulo (2006) showed that people were more correct at distinguishing lies from the truth in audiovisual presentations, audio presentations or transcripts than in video-only presentations. Hence, people who could only use video images for their judgements were less accurate, probably because they could only use their (non-verbal) liar stereotypes. Similarly, judges who direct their attention more on verbal content cues achieved higher accuracy in classifying true and deceptive statements than judges who direct their attention more on stereotypical non-verbal cues of deception (Reinhard, 2010; Reinhard et al., 2011).

2 | THE PRESENT RESEARCH

Five experiments (total number of judges = 1309, total number of messages = 464, total number of judgements = 19,634) tested whether lie and truth detection would be more accurate among people feeling personally uncertain compared to others. Higher accuracy in veracity judgements should manifest because uncertainty leads to more intensive use of verbal cues with, simultaneously, less reliance on non-verbal (stereotypical) cues. In contrast, people with lower uncertainty should use more non-verbal cues but fewer verbal cues.

Truth and lie statements were given in video recordings in which speakers talked about a job they had held (Experiments 1–3) or conveyed opinions about a movie (Experiment 4) or a person they met (Experiment 5). After watching each video, participants indicated whether they thought the speaker was truthful or telling a lie. All experiments calculated truth-lie detection accuracy as key outcomes based on these judgements. In Experiments 3 and 4, we additionally tested whether participants chose to meet more of those stimulus persons who told the truth versus lied. Lies convey that one is not being respected or valued and could endanger one's well-being, security and safety. Hence, sensing that one has been lied to should engender a hesitancy to interact with the liar. Consistent with the thesis that personal uncertainty renders people sensitive to whether they are being treated fairly, we predicted that people in a state of personal uncertainty versus a neutral state would choose more truthful persons as those they would like to meet. In all five experiments, we report all measures, manipulations and exclusions. Sample size in all five experiments was determined before any data analysis.

3 | EXPERIMENT 1

Experiment 1 had people recall a time when they felt personally uncertain or performed a neutral activity (watched television). Participants made veracity judgements about 14 videos of speakers describing a previous job. We predicted that truth and lie detection would be elevated among participants assigned to the uncertainty condition compared to the neutral condition.

3.1 | Method

3.1.1 | Participants and design

Two hundred and twenty-three students (114 women, 109 men, M age = 22.98 years, SD = 3.85) participated in partial fulfilment of course requirements or €6. The design was a 2 × 2 mixed-model design with uncertainty salience (uncertainty vs. neutral) as a between-participants variable and type of message (truthful vs. deceptive) as a within-participants variable. A *sensitivity power analysis* (G*Power; Faul et al., 2009) for the given sample size of $N = 223$ (correlation between repeated measures of $r = 0.039$, $\alpha = 0.05$) showed that a minimum effect size of $d = 0.27$ could be detected with a power of 80%.

3.1.2 | Stimulus materials

The stimulus materials were taken from Reinhard, Scharmach and Müller (2013). Seven female and seven male students participated in a study on job interviews. Each speaker recorded two 2-min videos, telling a truth or a lie. The order in which the videos were recorded was counterbalanced. For each video, participants first prepared for 5 min.

Speakers described a job they had held, such as its tasks, where and when it took place, and what they liked and disliked about the job. In the truth condition, speakers discussed a job they had held. In the deception condition, speakers discussed a job they had not held as if they had. The job they described was determined by selecting one of 21 typical student jobs printed on slips of paper, drawn out of a bowl. If the job they drew was one they had actually had, they re-drew until they drew a job that they had not held.

The camera was positioned such that speakers' heads and bodies were recorded. They were instructed to appear as truthful as possible and informed that they could receive €5 extra if the interviewer (who was blind to the veracity condition) believed that they had indeed done the job. This procedure yielded two sets of 14 videos, each containing seven truthful and seven deceptive messages (with each speaker included only once).

3.1.3 | Procedure

Participants were randomly assigned to one of two conditions. Following earlier research (e.g., Van den Bos, 2001), participants in the uncertainty salience condition imagined feeling uncertain about themselves. They wrote responses to two open-ended questions, 'What emotions does the thought of you being uncertain about yourself arouse in you?' and 'What will happen physically to you as you feel uncertain about yourself?' Participants in the neutral condition imagined watching TV. They wrote responses to two questions, 'What emotions does the thought of you watching TV arouse in you?' and 'What will happen physically to you as you watch TV?'

Next, participants completed a state version of the Positive and Negative Affect Schedule (PANAS; Watson et al., 1988) to report how they felt at the moment. We sought to check whether the manipulation had mood effects. Items (e.g., 'excited', 'guilty') were assessed on a five-point scale (1 = *not at all*, 5 = *extremely*). The two subscales measuring positive affect and negative affect were reliable (both Cronbach's αs = 0.76), and item values were averaged for the positive and negative mood scores.

For the manipulation check, two items assessed the degree and strength of uncertainty-related thoughts during the initial writing task, and two similarly worded items did the same for television-related thoughts (1 = *definitely did not*, 7 = *definitely did*; 1 = *very weak*, 7 = *very strong*). The two items for uncertainty-related thoughts were averaged to form a personal uncertainty salience index (Cronbach's $\alpha = 0.62$); the same was done for the two items on television-related thoughts (Cronbach's $\alpha = 0.80$).

Next, participants were seated in front of a computer and were told that they would see 14 short videos of students describing a job they had done while at university. Participants were then informed that people sometimes lie about jobs they had done in the past, saying they held a job they had never done. After these instructions, participants viewed the videos. Immediately after watching each video, they indicated whether they believed the student had actually done the job (0 = *no*, 1 = *yes*).

3.2 | Results

3.2.1 | Manipulation checks

A multivariate analysis of variance (MANOVA) on the uncertainty and television salience scales (intercorrelation: $r(221) = 0.17$, $p = .012$) indicated significant effects of the uncertainty manipulation at the multivariate level, $F(2, 220) = 11.17$, $p < .001$, $\eta_p^2 = 0.092$, 90% CI [0.036, 0.152].

As expected, uncertainty was more salient in the uncertainty than in the television condition and vice versa for TV salience. Further, we tested whether the uncertainty manipulation incidentally affected mood. A MANOVA with positive and negative affect (intercorrelation: $r(221) = -0.58$, $p < .001$) yielded a significant effect of uncertainty salience at the multivariate level $F(2, 220) = 75.46$, $p < .001$, $\eta_p^2 = 0.407$, 90% CI [0.323, 0.473]. Participants in the television condition reported more positive affect than participants in the uncertainty salience condition and vice versa for negative affect (see Table 1 for the univariate results and descriptive statistics of the manipulation checks of the reported experiments).

We also tested whether the uncertainty manipulation influenced participants' truth judgement rates. In none of the reported experiments did the manipulation have a significant effect on truth judgement rates. Detailed results of these analyses can be found in the supplementary material.

3.2.2 | Detection accuracy

Percentage judged true, and detection accuracies (in percent) for all, deceptive and true messages across uncertainty conditions are displayed in Table 1. Data were analysed by a 2 (uncertainty salience: salient vs. neutral) × 2 (message type: truthful vs. deceptive) × 2 (set of messages) mixed-model design ANOVA with detection accuracy (in %) as the dependent variable. In none of the reported experiments, did set of messages influence the effect of the uncertainty salience manipulation significantly. Hence, we do not report the results for set of messages here but focus on the uncertainty salience manipulation effect (see Table 2); interested readers can find the results of the full ANOVA models including set of messages in the supplementary material.

In line with our hypothesis, there was a significant effect of the uncertainty manipulation, $F(1, 219) = 3.97$, $p = .048$, $\eta_p^2 = 0.018$, 90% CI[0, 0.057] (see Tables 2 and 3). As expected, participants in the uncertainty salient condition were more accurate in overall judging which messages were truths and which were lies than participants in the neutral condition (see also Figure 1), $d = 0.27$, 95% CI [0.007, 0.54]. While overall accuracy rates among participants in the neutral condition (see Table 1) were significantly lower than chance, $t(109) = -2.46$, $p = .015$, $d = -0.24$, 95% CI [−0.42., −0.05], participants in the uncertainty salient condition were neither significantly better nor worse than chance, $t(112) = 0.38$, $p = .707$, $d = 0.04$, 95% CI [−0.15, 0.22]. The interaction of the uncertainty manipulation with message type was not significant, indicating that the uncertainty manipulation's effects were consistent across videos showing truth-tellers and liars. There was no overall significant effect of message type. We further ran the detection accuracy analysis with both positive and negative mood as covariates. In this analysis the effect of uncertainty manipulation on overall accuracy was no longer significant, $F(1, 217) = 1.58$, $p = .211$, $\eta_p^2 = 0.007$, 90% CI [0, 0.057].

3.3 | Discussion

Experiment 1 found weak support for our prediction that salience of personal uncertainty leads to better detection of deception. Participants in the uncertainty condition could discriminate the deceptive and true messages more correctly than participants in the neutral condition. Furthermore, participants' overall accuracy after reminders of uncertainty did not differ from chance. In contrast, participants' overall accuracy was below chance level in the neutral condition. The manipulation of uncertainty influenced the mood of participants, and the effect of the uncertainty manipulation on overall accuracy was no longer significant when controlling for the mood of participants (see also Reinhard & Schwarz, 2012).

4 | EXPERIMENT 2

Experiment 2 tested the effect of personal uncertainty for individuals who had experience with conducting employment interviews such as those depicted in the messages of the employed stimulus material; participants made veracity judgements about eight videos of speakers who lied or told the truth about an internship they had previously done. We took the uncertainty manipulation from Experiment 1 but adjusted the neutral condition. Experienced interviewers and laypersons were randomly assigned to one of three conditions, either to the uncertainty condition, in which participants thought about feeling uncertain, or to one of two neutral conditions, in which they were either asked to think about writing emails or were given no task. This

TABLE 1 Descriptive statistics and univariate ANOVAs for testing the manipulation in Experiments 1–5.

					Conditions		
	Univariate				Uncertainty	Neutral	
Experiment 1	$F(1, 221)$	p	η_p^2	90% CI [LL, UL]	M (SD)	M (SD)	
Uncertainty salience	**7.99**	**.005**	**0.035**	[0.006, 0.083]	4.82 (1.68)	4.20 (1.61)	
TV salience	**9.65**	**.002**	**0.042**	[0.009, 0.092]	4.58 (2.07)	5.38 (1.77)	
PANAS positive	**112.86**	**<.001**	**0.338**	[0.256, 0.410]	2.45 (0.45)	3.35 (0.77)	
PANAS negative	**96.82**	**<.001**	**0.305**	[0.224, 0.378]	3.55 (0.47)	2.70 (0.79)	
					Uncertainty	$Neutral_{emails}$	$Neutral_{notask}$
Experiment 2	$F(2, 224)$	p	η_p^2	90% CI [LL, UL]	M (SD)	M (SD)	M (SD)
Uncertainty salience	0.31	.733	0.003	[0, 0.017]	4.03 (1.92)	4.14 (1.95)	3.90 (1.82)
E-mail salience	0.48	.617	0.004	[0, 0.022]	1.60 (1.36)	1.81 (1.40)	1.61 (1.36)
PANAS positive	0.77	.466	0.007	[0, 0.029]	2.79 (0.59)	2.84 (0.66)	2.91 (0.63)
PANAS negative	2.15	.118	0.019	[0, 0.052]	1.24 (0.35)	1.36 (0.51)	1.40 (0.58)
					Uncertainty	Neutral	
Experiment 3	$F(1, 90)$	p	η_p^2	90% CI [LL, UL]	M (SD)	M (SD)	
Uncertainty salience	**11.76**	**.001**	**0.116**	[0.031, 0.221]	4.99 (1.95)	3.68 (1.69)	
TV salience	**16.49**	**<.001**	**0.155**	[0.056, 0.266]	2.77 (2.09)	4.84 (2.74)	
PANAS positive	0.50	.484	0.005	[0, 0.056]	3.19 (0.59)	3.28 (0.59)	
PANAS negative	1.09	.299	0.012	[0, 0.073]	2.31 (0.44)	2.41 (0.46)	
					Uncertainty	Neutral	
Experiment 4	$F(1, 140)$	p	η_p^2	90% CI [LL, UL]	M (SD)	M (SD)	
Uncertainty salience	**37.77**	**<.001**	**0.212**	[0.119, 0.305]	6.19 (2.28)	3.75 (2.45)	
TV salience	**63.09**	**<.001**	**0.311**	[0.208, 0.401]	2.59 (2.40)	6.19 (2.98)	
PANAS positive	0.33	.565	0.002	[0, 0.032]	3.03 (0.96)	2.93 (0.98)	
PANAS negative	0.06	.806	<0.001	[0, 0.019]	3.02 (0.86)	2.99 (0.92)	
					Uncertainty	Neutral	
Experiment 5	$F(1, 623)$	p	η_p^2	90% CI [LL, UL]	M (SD)	M (SD)	
Uncertainty salience	**177.71**	**<.001**	**0.222**	[0.176, 0.267]	4.57 (2.02)	2.54 (1.77)	
Certainty salience	**101.33**	**<.001**	**0.140**	[0.100, 0.182]	3.79 (1.94)	5.30 (1.81)	
PANAS positive	**5.60**	**.018**	**0.009**	[0, 0.025]	2.97 (0.93)	3.15 (0.95)	
PANAS negative	**9.19**	**.003**	**0.015**	[0.003, 0.034]	1.58 (0.74)	1.41 (0.68)	

Note: Significant effects at the univariate levels are displayed in bold.

experiment was conducted in a more applied context to examine whether expertise with the context and with detecting lies in this context interferes with the assumed effect of uncertainty. We adjusted the neutral condition to stay within the applied context and not discourage individuals with expertise by asking irritating questions. In addition, we included another control group in which the subjects started the lie detection task without having answered specific questions, similar to actual interview situations.

We predicted higher overall detection accuracy of truthful and deceptive messages in the uncertainty condition than in neutral conditions. Experiment 2 also tested the assumption that personal uncertainty leads to greater use of verbal information and that this leads to greater accuracy in detecting deception. This would mean that personal uncertainty itself does not have propensities that facilitate the detection of lies and truths. More precisely, it motivates people to consider verbal information that is difficult to process but can contain valid information relevant for distinguishing lies from the truth.

4.1 | Method

4.1.1 | Participants and design

Two hundred and twenty-seven participants (155 women, 72 men, M_{age} = 29.20, SD = 10.48) from different parts of Germany were recruited via various online channels such as web forums, groups in

TABLE 2 Detection accuracy and truth judgements across uncertainty salience conditions in Experiments 1–5.

			Detection accuracy (in %)						Messages judged true (in %)	
			Lies		Truths		Overall			
Exp.	Uncertainty condition	*n*	*M*	SD	*M*	SD	*M*	SD	*M*	SD
1	Uncertainty	113	48.80	20.62	52.21	20.54	50.51	14.28	51.71	14.83
	Neutral	110	45.06	19.47	48.18	19.14	46.62	14.37	51.56	12.89
2	Uncertainty	72	41.67	24.47	62.50	24.10	52.08	15.70	60.42	18.53
	$\text{Neutral}_{\text{emails}}$	59	44.07	23.37	58.90	25.75	51.48	19.43	57.42	15.06
	$\text{Neutral}_{\text{notask}}$	96	42.19	24.95	53.65	24.06	47.92	18.38	55.73	16.21
3	Uncertainty	46	53.42	23.99	56.83	21.61	55.12	16.61	51.71	15.66
	Neutral	46	46.27	22.57	49.38	20.58	47.83	15.57	51.55	14.98
4	Uncertainty	70	53.10	15.81	63.45	15.63	58.27	11.84	55.18	10.34
	Neutral	72	46.88	19.45	58.45	16.87	52.66	13.26	55.79	12.48
5	Uncertainty	310	42.02	19.42	61.81	18.73	51.91	11.88	59.90	14.93
	Neutral	315	40.95	19.18	61.43	20.28	51.19	12.15	60.24	15.55

social networks and the website of a German popular psychology magazine. Participants could win one of six vouchers worth €50 if they completed the entire questionnaire. The mean duration of the online study was 45 min. The study employed a 2 (interview experience: expert vs. layperson) × 3 (uncertainty salience: uncertainty salient vs. $\text{neutral}_{\text{emails}}$ vs. $\text{neutral}_{\text{notask}}$) × 2 (type of message: truthful vs. deceptive) mixed-model design with experience in conducting employment interviews as a quasi-experimental factor. Experts and laypersons were randomly assigned to one of the conditions of the between-subjects variable of uncertainty salience: the uncertainty salience condition, a neutral condition in which participants were asked to think of them writing emails, or another neutral condition in which no task was employed and participants were led directly to the next part of the questionnaire. Type of message (truthful vs. deceptive) was a within-participants factor.

A *sensitivity power analysis* (G*Power; Faul et al., 2009) for the given sample size of $N = 227$ (correlation between repeated measures of $r = 0.066$, $\alpha = 0.05$) showed that a minimum effect size of $\eta_p^2 = .022$ could be detected with a power of 80%.

4.1.2 | Stimulus material

We used a different stimulus material than in the previous experiment to obtain between-experiment stimulus replication. The stimulus material was taken from Reinhard, Greifeneder et al. (2013), Experiment 1). It was produced in a study with eight male students from the University of Mannheim as participants. Speakers were video recorded two times: one time, talking about their most recent internship, and another, talking about a fake, randomly assigned internship. The order of recording the actual and fake internships was counterbalanced. Speakers wore business clothing, received €15 for their participation, and were told they could win a bonus of €15 for successfully lying to the experimenter. The videos were recorded with a digital camera that was positioned so that the speakers' upper body and table parts were visible in the video, but not the interviewer. Before each interview, speakers were given 5 min to prepare for three questions ('When, where and for whom did you work?', 'What exactly did you do in your internship?', and 'What did you like/dislike about your internship?'), which were to be the basis for their story about the respective internship. Two sets of messages were created from the recorded videos. Each contained four truthful and four deceptive messages with no speaker being twice in a set (see Reinhard, Greifeneder et al., 2013, for more information).

4.1.3 | Procedure

First, participants were informed that the online study dealt with the process of lie detection in employment interviews. They gave demographic data on their gender, age, education and working experience. Participants' interview experience was measured by asking how many employment interviews they had conducted during their working life. Additionally, participants indicated how many interviews they had conducted during the last 2 years and how many interviews they conducted in their current job per year. Next, they self-evaluated their interview experience by rating two items ('How experienced are you in conducting employment interviews?' and 'How familiar are you with conducting employment interviews?', $\alpha = 0.94$) on a seven-point scale ranging from 1 (*not at all*) to 7 (*completely*). Participants also stated if they had any educational training concerning personnel selection.

After measuring interview experience, participants were randomly assigned to one of the three conditions of uncertainty (uncertainty salience vs. $\text{neutral}_{\text{emails}}$ vs. $\text{neutral}_{\text{notask}}$). Following previous research (e.g., Van den Bos, 2001), participants in the uncertainty condition were asked to imagine feeling uncertain about themselves. They answered the following two questions in written form: (1) 'What emotions does

TABLE 3 Mixed ANOVA for detection accuracy in Experiments 1–5.

Experiment 1	df	*F*	*p*	η_p^2	90% CI [LL, UL]
Between-subjects effects					
Uncertainty	1	3.972	.048*	0.018	[0, 0.057]
Within-subjects effects					
Message type	1	2.58	.110	0.012	[0, 0.046]
Message type * Uncertainty	1	0.03	.959	<0.001	[0, 0.009]
Error	219				
Experiment 2	*df*	*F*	*p*	η_p^2	90% CI [LL, UL]
Between-subjects effects					
Uncertainty	2	1.67	.191	0.015	[0, 0.046]
Within-subjects effects					
Message type	1	47.25	<.001***	0.176	[0.215, 0.370]
Message type* Uncertainty	2	1.48	.230	0.013	[0, 0.042]
Error	221				
Experiment 3	df	*F*	*p*	η_p^2	90% CI [LL, UL]
Between-subjects effects					
Uncertainty	1	5.02	.028*	0.054	[0.003, 0.145]
Within-subjects effects					
Message type	1	1.04	.311	0.012	[0, 0.073]
Message type * Uncertainty	1	0.04	.847	<0.001	[0, 0.025]
Error	88				
Experiment 4	df	*F*	*p*	η_p^2	90% CI [LL, UL]
Between-subjects effects					
Uncertainty	1	7.67	.006**	0.053	[0.009, 0.125]
Within-subjects effects					
Message type	1	34.24	<.001***	0.201	[0.108, 0.294]
Message type * Uncertainty	1	0.19	.663	0.001	[0, 0.029]
Error	136				
Experiment 5	df	*F*	*p*	η_p^2	90% CI [LL, UL]
Between-subjects effects					
Uncertainty	1	1.14	.285	0.002	[0, 0.012]
Within-subjects effects					
Message type	1	269.94	<.001***	0.316	[0.266, 0.362]
Message type * Uncertainty	1	<0.01	.952	<0.001	-
Error	585				

Note: Full results of the ANOVA models including the effects of set of messages can be found in the online supplementary file.
$^*p < .05$ $^{**}\ p < .01$ $^{***}\ p < .001$.

the thought of you being uncertain about yourself arouse in you?' and (2) 'What will happen physically to you as you feel uncertain about yourself?'. Participants in the neutral$_{emails}$ condition were asked to imagine writing e-mails. They answered two questions in written form: (1) 'What emotions does the thought of you writing e-mails arouse in you?' and (2) 'What will happen physically to you as you write e-mails?'. Participants in the neutral$_{notask}$ condition received no manipulation and were led directly to the PANAS. As in Experiment 1, positive ($\alpha = 0.84$) and negative affect ($\alpha = 0.90$) were measured for all participants after the manipulation.

Next, participants were randomly assigned to one of two sets of messages randomly presented to the participants. After each video, participants indicated whether they believed that the person in the video had really done the internship or not. For each of the eight judgements, participants rated how confident they were in the respective judgement on a seven-point scale ranging from 1 (*not confident*

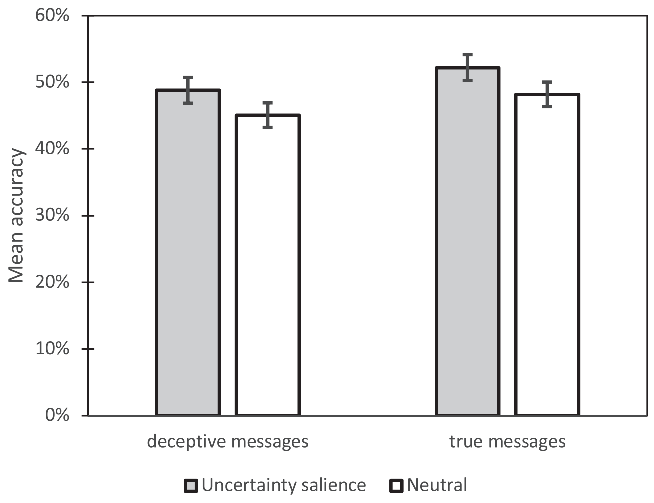

FIGURE 1 Mean accuracy classification of true and deceptive messages as a function of uncertainty in Experiment 1. Error bars indicate standard error of mean (SEM).

at all) to 7 (*very confident*). After participants had seen all videos, they stated how many messages they believed they had judged correctly.

Next, participants filled in the manipulation check and were asked whether (1 = *definitely did not*, 7 = *definitely did*) and to what extent (1 = *very weak*, 7 = *very strong*) they had been thinking about uncertainty (α = 0.93) and about writing e-mails (α = 0.90). Further, participants rated their motivation to detect the lies in the videos on two items with a seven-point scale from 1 (*very low*) to 7 (*very high*). Participants' usage of verbal and non-verbal cues was assessed using four items ('I focused mainly on verbal cues (i.e., on what was said) when watching the videos' and 'I based my judgement mainly on verbal cues (i.e., on what was said)', for non-verbal cues respectively). The items for cue usage were assessed on a seven-point scale (*1 = definitely did not*, *7 = definitely did*), with Cronbach's alpha being 0.89 for verbal cue usage and 0.90 for non-verbal cue usage. Beliefs about cues to deception were assessed using the same set of cues as Reinhard (2010). Participants selected one of three options for each cue; they indicated whether they believed that people show the respective behaviour more (1) or less (2) when they are lying or whether the behaviour does not indicate whether someone is lying (3).

Lastly, measures of participants' dispositional self-uncertainty were assessed. The five-item Labile Self Esteem Scale, developed by Dykman (1998), was measured on a five-point scale (*1 = strongly disagree*, *5 = strongly agree*) with a Cronbach's alpha of 0.90 (items taken from De Cremer & Sedikides, 2005, e.g., 'Compared to most people, my self-esteem changes rapidly'). The 15 items of the Emotional Uncertainty subscale (e.g., 'When a situation is unclear, it makes me feel angry') taken from Greco and Roger (2001) was measured on a four-point scale ranging from 1 (*never*) to 4 (*always*) with a Cronbach's alpha of 0.89. As a control variable, the item 'I have high self-esteem' from the single-item-self-esteem-measure by Robins et al. (2001) was rated on a five-point scale (*1 = strongly disagree*, *5 = strongly agree*). Finally, participants received feedback on the number of correct judgements and were thanked for their participation. Additional results on motivation, interview experience, beliefs about cues to deception, (labile) self-esteem and emotional uncertainty can be found in the online supplementary material.

4.2 | Results

4.2.1 | Manipulation checks

A MANOVA on the uncertainty and e-mail salience scales (r(224) = 0.07, p = .311) found no effect of the manipulation at the multivariate level, F(4, 446) = 0.35, p = .845, η_p^2 = 0.003, 90% CI[0, 0.006], indicating that the manipulations did not work as intended. Also, the univariate analyses revealed no effects (see Table 1). Unexpectedly, uncertainty was not more salient in the uncertainty condition than in the neutral$_{emails}$ condition, t(129) = −0.30, p = .767, d = −0.05, 95% CI [−0.40, 0.29], and not more salient than in the neutral$_{notask}$ condition, t(166) = 0.48, p = .633, d = 0.08, 95% CI [−0.24, 0.38]. Writing e-mails was also not more salient in the neutral$_{emails}$ condition than in the uncertainty condition, t(128) = 0.85, p = .399, d = 0.15, 95% CI [−0.19, 0.50], and not more salient than in the neutral$_{notask}$ condition, t(152) = 0.89, p = .376, d = 0.15, 95% CI [−0.18, 0.47]. A MANOVA on the positive and negative affect scales (intercorrelation: r(221) = -0.01, p = .644) revealed no effect of the manipulation at the multivariate level, F(4, 440) = 1.50, p = .202, η_p^2 = 0.013, 90% CI [0, 0.028] (see Table 1 for the univariate results and descriptive statistics of the manipulation checks of the reported experiments).

4.2.2 | Detection accuracy

We used a 3 (salience: uncertainty salient vs. e-mail salient vs. no task) × 2 (message type: truthful vs. deceptive) × 2 (set of messages) mixed ANOVA with detection accuracy (in %) as the dependent variable. Contrary to our predictions, there was no main effect of uncertainty, F(2, 221) = 1.67, p = .191, η_p^2 = 0.015, 90% CI [0, 0.046] (see Table 2). Participants in the uncertainty salience condition were neither more accurate than participants in the neutral$_{emails}$ condition, t(129) = 0.20, p = .845, d = 0.03, 95% CI [−0.31, 0.38], nor more accurate than participants in the neutral$_{notask}$ condition, t(166) = 1.55, p = .124, d = 0.24, 95% CI [−0.31, 0.38]. The two neutral conditions also did not differ, t(153) = 1.15, p = .253, d = 0.19, 95% CI [−0.14, 0.51] (see Figure 2). Detection accuracy rates (see Table 1) did not exceed chance level, neither for participants in the uncertainty condition, t(71) = 1.13, p = .264, d = 0.13, 95% CI [−0.20, 0.46], nor for participants in the neutral$_{emails}$ condition, t(58) = 0.59, p = .560, d = 0.08, 95% CI [−0.29, 0.44], or neutral$_{notask}$ condition, t(95) = −1.11, p = .269, d = −0.11, 95% CI [−0.40, 0.17]. Message type was significant with participants being better at judging truths as non-deceptive

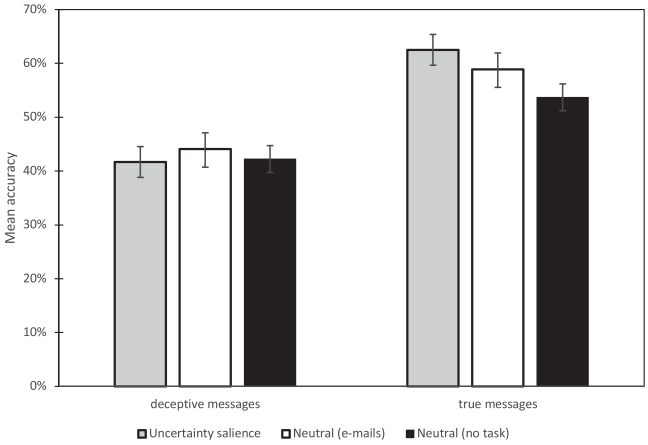

FIGURE 2 Mean detection accuracy of true and deceptive messages as a function of uncertainty in Experiment 2. Error bars indicate standard error of mean (SEM).

than at detecting lies as deceptive. The interaction of message type and uncertainty was not significant, indicating that the hypothesized improving effect occurred neither for true nor for deceptive messages.

We further run the detection accuracy analysis with both positive and negative mood as covariates. In this analysis the effect of uncertainty manipulation was also not significant, $F(2, 215) = 1.48$, $p = .230$, $\eta_p^2 = 0.014$, 90% CI [0, 0.044]. Additional analyses in which interview experience was added to the above mixed ANOVA revealed neither a significant main effect of interview experience nor a significant interaction with uncertainty; these analyses can be found in the online supplementary materials. Analysis with motivation, beliefs about cues to deception, (labile) self-esteem, and emotional uncertainty found no significant main effects or interaction effects with the uncertainty manipulation on accuracy.

4.2.3 | Use of verbal and non-verbal information

Self-reported use of verbal information was negatively correlated with self-reported use of non-verbal information, $r(225) = -0.23$, $p < .001$. Contrary to the predictions, a MANOVA with uncertainty salience and set of messages as independent variables and self-reported use of verbal and non-verbal information as the dependent variables, yielded no significant effect of uncertainty at the multivariate level, $F(2, 221) = 1.20$, $p = .311$, and at the univariate levels (verbal: $F(2, 221) = 0.40$, $p = .668$, $\eta_p^2 = 0.004$, 90% CI [0, 0.020], non-verbal: $F(2, 221) = 1.99$, $p = .139$, $\eta_p^2 = 0.018$, 90% CI [0, 0.051]). Detailed information can be found in the online supplementary materials.

4.3 | Discussion

Experiment 2 did not replicate the previously found improving effect of personal uncertainty on lie detection accuracy; detection accuracy did not differ between the uncertainty salience condition and the two neutral conditions. Participants in the uncertainty condition reported neither more use of verbal cues nor less use of non-verbal cues compared to participants in the neutral conditions. However, because three conditions did not differ on the manipulation check measures, the manipulation might not have worked as intended and the hypotheses examined in Experiment 2 required further testing.

5 | EXPERIMENT 3

In Experiment 3, we returned to the manipulation as used in Experiment 1 with TV salience in the neutral condition because, unlike the adjusted manipulation in Experiment 2, it yielded the desired differences on the manipulation check. Further, participants made veracity judgements about the same stimulus materials as in Experiment 1. Experiment 3 again tested the assumption that personal uncertainty leads to greater use of verbal information and that this leads to greater accuracy in detecting deception. Because uncertainty may play a role especially when it is personally relevant for individuals to determine who is lying, we increased the personal relevance of the lie/truth judgements. Participants not only judged whether each speaker was telling the truth or a lie; after the video viewing task, they indicated which speakers they would like to have in their group for a work task. We predicted that truth and lie detection would be elevated among participants assigned to the uncertainty condition compared to the neutral condition, and more truth-tellers would be selected for the work task.

5.1 | Method

5.1.1 | Participants and design

Ninety-two students (41 female; 51 male; M age = 22.9 years) participated in partial fulfilment of course requirements or €6. The design was a 2 × 2 mixed-model design with uncertainty salience (uncertainty vs. neutral) as a between-participants variable and type of message (truthful vs. deceptive) as a within-participants variable. A *sensitivity power analysis* (G*Power; Faul et al., 2009) for the given sample size of $N = 92$ (correlation between repeated measures of $r = 0.075$, $\alpha = 0.05$) showed that a minimum effect size of $d = 0.43$ could be detected with a power of 80%.

5.1.2 | Procedure

Participants were randomly assigned to one of the two conditions of the uncertainty manipulation, which was the same as in Experiment 1. In the uncertainty condition, participants imagined and wrote about feeling uncertain about themselves. In the neutral condition, participants imagined and wrote about how they felt watching television (Van den Bos, 2001). As in the previous experiments, participants' positive (α = 0.70) and negative (α = 0.61) affect was assessed using the PANAS. The same manipulation check as in Experiment 1 was used; the salience of uncertainty thoughts (α = 0.73) and thoughts about watching television (α = 0.88) was assessed using two items each.

Next, participants were seated in front of a computer. They were told that they would watch 14 short videos of students describing a job they had done while at university. Participants were then informed that people sometimes lie about jobs they had done in the past, saying they held a job they had never done. Participants learned that they would engage with other students in teamwork. They were further told that after they had seen and evaluated all interviews, they could choose six students with whom to work on the later teamwork task. Participants were informed that their reward would be determined by the quality of the teamwork (up to €10). After these instructions, participants viewed the videos. Participants had to indicate after each video whether they believed the student had actually done the job (0 = *no*, 1 = *yes*).

Four items assessed participants' self-reported use of verbal (α = 0.83) and non-verbal (α = 0.84) information (Reinhard et al., 2011). The items for verbal information were 'I based my judgement more on the verbal content' and 'I based my judgement more on the verbal behaviour' (1 = *definitely did not*, 7 = *definitely did*); the word 'verbal' was replaced with 'non-verbal' for the non-verbal items.

Next, participants looked over a sheet with photos of the 14 students whose videos they viewed. For the supposed teamwork task that would follow, participants selected six of the speakers by crossing the box next to the respective photo. Last, participants indicated their age and gender and were told that the teamwork task would not occur.

5.2 | Results

5.2.1 | Manipulation checks

A MANOVA on the uncertainty and television salience scales, intercorrelated with $r(90)$ = -0.21, p = .041, confirmed the expected effect of the manipulation at the multivariate level, $F(2, 89)$ = 12.81, p < .001. As expected, thoughts of uncertainty were higher in the uncertainty condition than in the neutral condition and vice versa for TV salience. A MANOVA with positive and negative affect (intercorrelation: $r(90)$ = −0.36, p < .001) indicated no significant effects of the salience manipulation at the multivariate level, $F(2, 89)$ = 0.60, p = .551, η_p^2 = 0.013, 90% CI [0, 0.060]. Thus, in this experiment, the salience manipulation cannot be equated with a mood manipulation (see Table 1 for the univariate results and descriptive statistics of the manipulation checks).

5.2.2 | Detection accuracy

Data were analysed by a 2 (uncertainty salience: salient vs. neutral) × 2 (message type: truthful vs. deceptive) × 2 (set of messages) mixed-model design ANOVA with detection accuracy (in %) as the dependent variable. In line with the hypothesis, the main effect of the uncertainty manipulation was significant, $F(1, 88)$ = 5.02, p = .028, η_p^2 = 0.054, 90% CI [0.003, 0.145] (see Table 2). Participants in the uncertainty salient condition were more accurate in their lie-truth classification than participants in the neutral condition, d = 0.45, 95% CI [0.04, 0.87] (see Figure 3). While participants in the uncertainty salient condition (see Table 1) were significantly better than chance (50%) in classifying true and deceptive messages, $t(45)$ = 2.09, p = .042, d = 0.31, 95% CI [0.01, 0.60], participantst' classification accuracy in the neutral condition did not significantly differ from chance, $t(45)$ = −0.95, p = .349, d = −0.14, 95% CI [−0.43, 0.15].

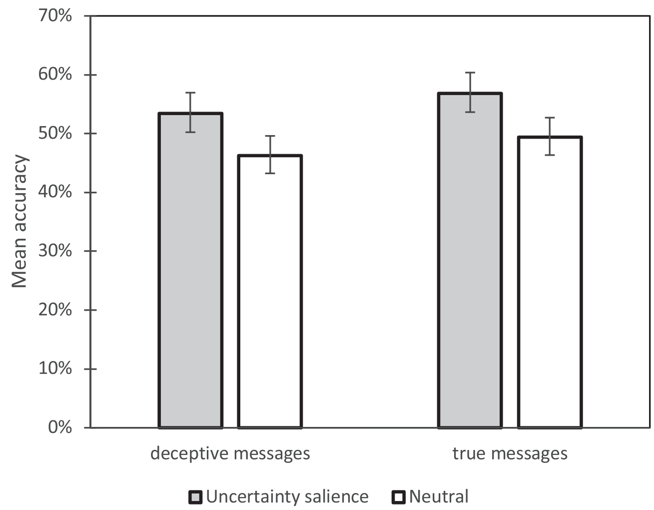

FIGURE 3 Mean accuracy classification of true and deceptive messages as a function of uncertainty in Experiment 3. Error bars indicate standard error of mean (SEM).

Neither the main effects of type of message, nor the interaction of uncertainty with type of message were significant, indicating that the effect of uncertainty was consistent across deceptive and true messages (see Figure 3). We further ran the detection accuracy analysis with both positive and negative mood as covariates. In this analysis the effect of uncertainty manipulation was still significant, $F(1, 86)$ = 5.08, p = .027, η_p^2 = 0.056, 90% CI [0.003, 0.148].

5.2.3 | Choice of work partner

As expected, participants in the uncertainty condition chose significantly more truth-telling speakers (M = 3.43, SD = 1.07) than did participants in the neutral condition (M = 2.99, SD = 0.54), $F(1, 90)$ = 6.71, p = .011, η_p^2 = 0.069, 90% CI [0.009, 0.165]. Participants in the uncertainty condition selected significantly more truth-tellers than would be expected by chance (3), $t(45)$ = 2.76, p = .008, d = 0.40, 95% CI [0.10, 0.71]. This was not true for participants in the neutral condition, t(45) = −0.28, p = .785, d = −0.04, 95% CI [−0.33, 0.25]. When we controlled for message set, the main effect of uncertainty on number

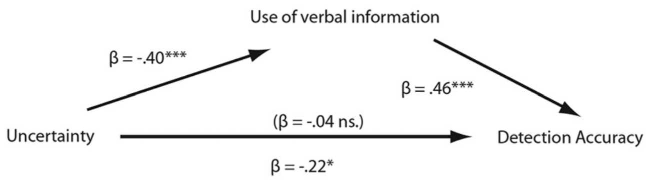

FIGURE 4 Mediation of uncertainty effects on detection accuracy in Experiment 3: Uncorrected effects, and effects corrected for use of verbal information, of uncertainty (0 = Neutral Condition, 1 = Uncertainty) on the detection accuracy.
Note: Coefficients appearing above lines are beta weights for uncorrected paths; coefficients in parentheses appearing below lines are beta weights for corrected paths. *$p < .05$; **$p < .01$; ***$p < .001$.

of truthful stimulus persons chosen was still significant, $F(1, 88) = 7.33$, $p = .008$, $\eta_p^2 = 0.077$, 90% CI [0.011, 0.176].

5.2.4 | Use of verbal and non-verbal information

Self-reported use of verbal information was not significantly correlated with self-reported use of non-verbal information ($r(90) = -0.12$, $p = .259$). A MANOVA, with uncertainty salience and set of messages as independent variables and self-reported use of verbal and non-verbal information as the dependent variables, yielded a significant effect of uncertainty at the multivariate level, $F(2, 89) = 9.50$, $p = < .001$, and at the univariate levels for verbal, $F(1, 88) = 15.06$, $p < .001$, $\eta_p^2 = 0.15$, 90% CI [0.049, 0.257], but not for non-verbal information, $F(1, 88) = 3.85$, $p = .053$, $\eta_p^2 = 0.042$, [0, 0.127]. Set of messages had no significant effects. In line with the predictions, participants in the uncertainty condition reported more use of verbal information ($M = 5.38$, SD = 1.11) than did participants in the neutral condition ($M = 4.17$, SD = 1.67), $d = 0.85$, 95% CI [0.42, 1.28]. Participants in the uncertainty condition reported slightly less use of non-verbal information ($M = 4.45$, SD = 1.30) than did participants in the neutral condition ($M = 4.97$, SD = 1.47), $d = -0.38$, 95% CI [−0.78, 0.04], but this effect was not statistically significant.

5.2.5 | Mediation of detection accuracy

Regression analyses supported the hypothesized mediational effect of use of verbal information on detection accuracy. In Step 1, uncertainty (neutral condition = 1, uncertainty salient condition = 0) significantly predicted detection accuracy ($\beta = -0.22$, $p = .032$). In Step 2, uncertainty predicted participants' self-reported use of verbal information ($\beta = -0.40$, $p < .001$). In Step 3, participants' self-reported use of verbal information predicted participants' detection accuracy ($\beta = 0.47$, $p < .001$). In Step 4, the relationship between uncertainty salience and detection accuracy was reduced to non-significance when accuracy was regressed on uncertainty and reported use of verbal information ($\beta = -0.04$, $p = .668$; see also Figure 4). A Sobel test indicated that the effect of uncertainty salience on detection accuracy was indeed significantly mediated by self-reported use of verbal information, $z = 3.01$, $p < .001$.[1] Similarly, the bootstrapping procedure using the PROCESS macro for SPSS (see Hayes, 2018, for the documentation) revealed a partially standardized indirect effect of −0.36, 95% CI [−0.63, −0.15].[2]

5.3 | Discussion

Contrary to Experiment 2, Experiment 3 replicated the results from Experiment 1 and additionally extended them to a different motivational situation (personal relevance of detecting lies). As predicted, participants in the uncertainty salience condition achieved higher detection accuracy than participants in the neutral condition. They also chose more truth-tellers for the work task than participants in the neutral condition. Supporting the assumption that the improving effect of uncertainty salience works via increased motivation to discern truth from deception, participants in the uncertainty condition reported using more verbal cues than participants in the neutral condition. As hypothesized, the use of verbal cues mediated the effect of uncertainty on detection accuracy. However, because people do not necessarily have insight into their mental processes and often report their lay theories instead of their actual cognitive processes (Nisbett & Wilson, 1977), results on the use of cues should be viewed with caution.

6 | EXPERIMENT 4

Experiment 4 used the same manipulation as Experiment 1 and participants made veracity judgements about 24 videos of speakers describing and evaluating a movie they had seen. To increase personal relevance, similar to Experiment 3, participants indicated which speakers they would like to meet for a following friendly conversation. We predicted that truth and lie detection would be elevated among participants assigned to the uncertainty condition and that they would want to meet more truth-tellers than would participants in the neutral condition.

Due to the problems of self-reports described in Experiment 3, we approached the topic of cue usage with a different method for Experiment 4; we used objectively coded cues of the employed stimulus

[1] When the use of verbal information was regressed on uncertainty and detection accuracy, the relationship between the use of verbal information and uncertainty was still significant ($\beta = -0.31$, $p = .001$), indicating no reverse mediation. Moreover, as expected, further analysis showed that the use of non-verbal information was no full mediator of the effect of uncertainty on classification accuracy. Uncertainty did not significantly influence use of non-verbal information ($\beta = 0.19$, $p = .074$). The relationship between uncertainty salience and detection accuracy was reduced to non-significance when accuracy was regressed on uncertainty and reported use of non-verbal information ($\beta = -0.17$, $p = .101$). In addition, the Sobel test, indicating that the mediator (self-reported use of non-verbal information) carries the influence of uncertainty salience on prediction of detection accuracy, was not significant, $z = 1.55$, $p = .12$.

[2] The partially standardized indirect effect expresses the indirect effect relative to the standard deviation of the outcome variable, in the mediation model here, to the standard deviation of the overall detection accuracy. The partially rather than the completely standardized effect is reported here as it is more meaningful for cases with a dichotomous independent variable (see e.g., Hayes, 2018; MacKinnon, 2008).

material. We hypothesized that participants in the uncertainty condition would use more verbal and paraverbal cues in their lie/truth judgements than participants in the neutral condition. Because non-verbal cues are often highly salient (e.g., posture change) and some are among the most frequently reported beliefs about signs of deception (e.g., gaze aversion, see Global Deception Research Team, 2006), participants in both conditions were expected to use non-verbal cues. Furthermore, we predicted that participants in the uncertainty condition would use verbal and paraverbal cues in agreement with the objective validity of these cues, whereas participants in the neutral condition should not. We expected no difference between the conditions regarding the agreement of cue usage and objective validity for non-verbal cues.

6.1 | Method

6.1.1 | Participants and design

One hundred and forty-two (68 female and 74 male) students (*M* age = 24.02 years, SD = 7.29) participated in partial fulfilment of departmental requirements. The study lasted 20 min. The design was a 2 × 2 mixed-model design. Uncertainty salience (uncertainty salient vs. neutral) was a between-participants variable, and type of message (truthful vs. deceptive) was a within-participants variable. A *sensitivity power analysis* (G*Power; Faul et al., 2009) for the given sample size of $N = 142$ (correlation between repeated measures of $r = 0.116$, $\alpha = 0.05$) showed that a minimum effect size of $d = 0.35$ could be detected with a power of 80%.

6.1.2 | Stimulus materials

Because messages play a major role in terms of lie detection accuracy (Volz et al., in press), a high number of messages is important when examining potential effects on accuracy (see also Levine et al., 2022). Hence, we employed stimulus material that contained more messages than the previously used materials. The stimulus materials were taken from Reinhard (2010, Experiment 3). Seventy-two (36 female and 36 male) students from the same population as the main study participated in a study on personal attitudes. Using a validated methodology (e.g., DePaulo et al., 1982; Frank & Ekman, 1997), speakers recorded 1-min videos describing their opinions of a movie. The camera was placed so that participants' heads and upper bodies were visible in the recordings. Speakers were given one of four instructions: either to lie or tell the truth and, orthogonal to this condition, to provide a positive or negative opinion. In other words, speakers who were instructed to tell the truth described a movie they really liked or a movie they disliked. Speakers who were instructed to lie either described a movie they actually liked as if they disliked it, or a movie they actually disliked as if they liked it. Speakers were told to appear as truthful as possible and that they could get an extra reward of €5 if the interviewer (who was blind to condition) believed that they were telling the truth in the recording. These procedures yielded 72 messages which were randomly assigned to three sets of messages, so that each set consisted of 12 truthful and 12 deceptive messages. The valence of attitudes and speakers' gender were balanced across conditions and message sets.

Ratings of 27 objective verbal, paraverbal and non-verbal cues of the stimulus material were taken from Reinhard, Greifeneder et al. (2013). Previous research either found the coded cues to be objective cues of deception (DePaulo et al., 2003; Sporer & Schwandt, 2006, 2007) or believed cues of deception (Global Deception Research Team, 2006; Hartwig & Bond, 2011). More information on the coding process of the cues can be found in Reinhard, Greifeneder et al. (2013).

6.1.3 | Procedure

Participants were randomly assigned to one of the two conditions of the uncertainty manipulation, which was the same as in Experiment 1. In the uncertainty condition, participants imagined and wrote about feeling uncertain about themselves. In the neutral condition, participants imagined and wrote about how they felt watching television (Van den Bos, 2001). As in the previous experiments, participants' positive and negative affect (both αs = 0.85) was assessed using the PANAS. The same manipulation check as in Experiment 1 was used; the salience of uncertainty thoughts ($\alpha = 0.88$) and thoughts about watching television ($\alpha = 0.89$) was assessed using two items each.

Next, participants were told that they would participate in a new study. They were told that the study focused on how friendships develop, and, to that end, they would watch videos of fellow students of whom they would choose six to meet later in a getting-acquainted interaction. Participants were informed that the students in the videos were describing movies they liked or disliked and that some of the messages were true because speakers gave their real opinions whereas some messages were not true because the speakers said that they liked (disliked) a movie even though they disliked (liked) it.

Participants viewed one set of 24 messages on a computer screen and indicated immediately after watching each video whether they thought the video was a lie or the truth. After judging all messages, participants received a page with screenshots from the videos depicting the 24 individuals they saw in the videos. Participants were asked to tick the boxes next to the photos of the six individuals they would like to meet at the getting-acquainted meeting. Last, participants reported their age and gender and were told that the getting-acquainted meeting would not take place.

6.2 | Results

6.2.1 | Manipulation checks

A MANOVA on the uncertainty and television salience scales (inter-correlation: $r(140) = -0.24$, $p = .003$) revealed the expected effect of the manipulation at the multivariate level, $F(2, 139) = 50.94$, $p < .001$, $\eta_p^2 = 0.42$, 90% CI [0.316, 0.502]. As expected, thoughts of uncertainty

FIGURE 5 Mean accuracy classification of true and deceptive messages as a function of uncertainty in Experiment 4. Error bars indicate the standard error of the mean (SEM).

were higher the uncertainty condition than in the neutral condition and vice versa for TV salience. A MANOVA with positive and negative affect (intercorrelation: $r(140) = 0.92$, $p < .001$) indicated no significant effects of the salience manipulation at the multivariate level, $F(2, 139) = 0.42$, $p = .655$, $\eta_p^2 = 0.013$, 90% CI [0, 0.032]. Thus, in this experiment, the salience manipulation cannot be equated with a mood manipulation (see Table 1 for the univariate results and descriptive statistics of the manipulation checks).

6.2.2 | Detection accuracy

Data were analysed by a 2 (uncertainty salience: salient vs. neutral) × 2 (message type: truthful vs. deceptive) × 2 (set of messages) mixed-model design ANOVA with detection accuracy (in %) as the dependent variable. In line with hypotheses, there was a significant effect of the uncertainty manipulation, $F(1, 136) = 7.67$, $p = .006$, $\eta_p^2 = 0.053$, 90% CI [0.009, 0.125] (see Table 2). As expected, participants in the uncertainty salient condition (see Table 1) were more accurate in judging which messages were truths and which were lies than participants in the neutral condition, $d = 0.44$, 95% CI [0.11, 0.78] (see Figure 5). While overall accuracy rates among participants in the neutral condition did not differ significantly from chance, $t(71) = 1.70$, $p = .093$, $d = 0.20$, 95% CI [−0.03, 0.43], participants' overall accuracy in the uncertainty salient condition was significantly better than chance, $t(69) = 5.85$, $p < .001$, $d = 0.70$, 95% CI [0.44, 0.96].

The interaction of the uncertainty manipulation with message type was not significant, indicating that the effects of the uncertainty manipulation were consistent across videos showing truth-tellers and liars (see Figure 5). There was an overall significant effect of message type, such that participants were more accurate in classifying truthful messages as true than deceptive messages as lies. We further ran the detection accuracy analysis with both positive and negative mood as covariates. In this analysis the effect of uncertainty manipulation was still significant, $F(1, 134) = 8.35$, $p = .005$, $\eta_p^2 = 0.059$, 90% CI [0.011, 0.132].

6.2.3 | Choice of whom to meet

As expected, participants in the uncertainty condition chose significantly more stimulus persons who were telling the truth for the getting-acquainted meeting ($M = 3.10$, SD = 0.84) than did participants in the neutral condition ($M = 2.81$, SD = 0.88), $F(1, 140) = 4.16$, $p = .043$, $\eta_p^2 = 0.03$, 90% CI [0, 0.088]. Neither in the uncertainty condition, $t(69) = 1.00$, $p = .321$, $d = 0.12$, 95% CI [−0.12, 0.35], nor in the neutral condition, $t(71) = -1.87$, $p = .066$, $d = -0.22$, 95% CI [−0.45, 0.01], did participants on average select significantly more or fewer truth-tellers than would be expected by chance (3).

When we controlled for message set, the main effect of uncertainty on the number of truthful stimulus persons chosen was no longer significant, $F(1, 136) = 3.61$, $p = .060$, $\eta_p^2 = 0.026$, 90% CI [0, 0.084]. Neither the main effect of set of messages, $F(2, 136) = 0.86$, $p = .425$, $\eta_p^2 = 0.012$, 90% CI [0, 0.049] nor its interaction with uncertainty, $F(2, 136) = 0.39$, $p = .677$, $\eta_p^2 = 0.006$, 90% CI [0, 0.031] were significant.

6.2.4 | Use of verbal, non-verbal and paraverbal information

To test how participants used the cues depending on the assigned condition, we determined the use of each cue for the uncertainty and the neutral condition (subjective utilities). We estimated two logistic mixed-effects models for each cue to predict lie/truth judgements, one for each condition. The models were estimated in R (lme4 package, Bates et al., 2015) and included the respective cue as a fixed effect and random intercepts for participants and messages. Using the effect-size package in R (Ben-Shachar et al., 2020), the odds ratios of the cues' fixed effects were transformed into correlations. These correlations (subjective utilities) are displayed for the two conditions in Table 4, along with the point-biserial correlation of the cue with its actual status (objective validities). We transformed subjective utilities and objective validities into Fisher's *Zrs*. The intraclass correlation coefficient (ICC, two-way mixed effect model, average measure, estimated absolute agreement) between subjective utilities and objective validities for verbal and paraverbal cues in the uncertainty condition was 0.14 ($p = .388$), indicating low agreement between actual validity and cue usage. In the neutral condition, the negative ICC of −0.28 ($p = .686$) indicated that verbal and paraverbal cues were overall used in the opposite direction to the objective validities. For non-verbal cues, the ICCs were low in both conditions (uncertainty: ICC = 0.11, $p = .423$, neutral: ICC = 0.15, $p = .400$).

Contrary to the predictions, lie/truth judgements could be predicted from verbal and paraverbal cues for participants in the neutral, but not in the uncertainty condition. In the uncertainty condition, a model with verbal and paraverbal cues as fixed effects and random intercepts for participants and messages (Pseudo-R^2 fixed effects = 0.040,

TABLE 4 Correlations between occurrence of verbal, non-verbal and paraverbal cues to deception and lie/truth judgements (subjective utilities, estimated from odds ratios of logistic mixed effects models) and point-biserial correlations between the occurrence of the cues and truth status (objective validities).

Cue	Subjective utilities: Uncertainty	Subjective utilities: Neutral	Objective validities
Verbal cues			
Number of words	0.02	0.00	–0.10
Consistency	–0.05	-0.05	-0.10
Details (frequency)	–0.01	0.01	–0.12
Details (time)	0.01	0.00	-0.02
Details (profoundness)	0.02	0.05	–0.12
Mental status	0.00	–0.01	0.25*
Admitted lack of memory	0.01	-0.02	0.05
Non-verbal cues			
Nervous	0.00	–0.03	–0.09
Smiling	–0.01	–0.02	0.06
Eye contact	0.03	0.04	–0.02
Postural shifts	–0.04	–0.04	–0.26*
Foot/leg movements	0.03	0.02	0.02
Hand/finger movements	0.01	–0.02	–0.03
Chin raise	0.00	–0.01	–0.02
Involved/expressive	0.02	–0.02	0.02
Attractiveness	–0.01	–0.02	–0.03
Cooperativeness	0.01	0.00	–0.10
Friendly/pleasant	–0.01	–0.01	–0.07
Facial pleasantness	0.00	0.01	0.31*
Fidgeting	–0.02	–0.04	–0.02
Paraverbal cues			
Response length	–0.02	0.00	–0.10
Verbal/vocal uncertainty	–0.05	–0.02	0.16
Vocal pleasantness	–0.01	–0.02	0.05
Vocal tension	–0.03	–0.01	–0.27*
Unfilled pauses length	–0.04	0.03	–0.26*
Filled pauses length	–0.02	0.01	–0.28*
Word/phrase repetitions	–0.03	0.01	–0.24*

Note: Positive correlations indicate for subjective utilities that participants in the respective condition associated more frequent occurrence of cues with truth; positive point-biserial correlations for objective validities indicate more frequent occurrence of cues in true messages.
*$p < .05$

Pseudo-R^2 total = 0.151) did not predict lie/truth judgements better than the null model (Pseudo-R^2 total = 0.150), $\chi^2(14)$ = 16.19, p = .302. Unexpectedly, in the neutral condition, the same model with verbal and paraverbal cues (Pseudo-R^2 fixed effects = 0.042, Pseudo-R^2 total = 0.113) predicted lie/truth judgements better than the null model (Pseudo-R^2 total = 0.112), $\chi^2(14)$ = 26.51, p = .022. However, the AIC and BIC model parameters for the null model (AIC = 2328.7, BIC = 2345.1) were lower than for the model with verbal and paraverbal cues (AIC = 2330.1, BIC = 2422.9), suggesting that the better prediction was mainly due to the sheer number of predictors. The model with the non-verbal cues as fixed effects (Pseudo-R^2 fixed effects = 0.033 Pseudo-R^2 total = 0.151) did not predict lie/truth judgements better than the null model in the uncertainty condition, $\chi^2(13)$ = 12.84, p = .460. The same was true for the model with non-verbal cues in the neutral condition (Pseudo-R^2 fixed effects = 0.023, Pseudo-R^2 total = 0.111), $\chi^2(13)$ = 13.60, p = .403.

6.3 | Discussion

Experiment 4 found further support for our prediction that the salience of personal uncertainty leads to better detection of deception. Participants in the uncertainty condition were better at discriminating between the deceptive and true messages than participants in the neutral condition. They chose more truth-tellers for a later getting-acquainted meeting than participants in the neutral condition, but this effect was no longer significant when controlling for the set of messages. Assessing participants' use of information with objectively coded cues did not render support for the assumption that participants under uncertainty salience make more use of the more difficult to process verbal and non-verbal information. Unlike participants in the neutral condition, participants in the uncertainty condition used verbal and paraverbal cues in the direction of the objective validities of the cues. Still, the ICC for this agreement was not significant. For non-verbal cues, participants in both conditions used the cues in the direction of the objective validities, but ICCs were low and not significant. Yet, given the ICC was calculated over 14 cues for verbal/paraverbal cues (13 cues for non-verbal cues), the power to find a significant correspondence between subjective utilities and objective validities was low.

7 | EXPERIMENT 5

Experiment 5 employed a larger sample than the previous experiments to test the basic effect of uncertainty in a higher-powered, pre-registered experiment. This was done because of inconsistencies in the results of the above experiments, the unclear size of the potential effect, and the likely resulting power issues in the previous experiments. We used the uncertainty manipulation from Experiment 1 but adjusted the neutral condition; we asked participants to think about feeling certain rather than about watching TV. At the time of data collection, the coronavirus pandemic led governments to take drastic measures to prevent the spread of the virus and its damage. The situation was connected to high uncertainty due to the imminent danger, the high obscurity and dynamic of the situation, and the vast amounts of (contradictory) information on the media. Thus, thinking about watching TV could have induced feelings of uncertainty due to the vital link between watching TV and the coronavirus pandemic. Pre-testing the TV salience condition did not seem useful due to the dynamics of the situation at that time, so thinking about certainty was chosen for the control condition. We predicted that participants in the uncertainty condition compared to participants in the certainty condition would be more correct in their veracity judgements of 16 messages by speakers who either lied or told the truth about a person they liked or disliked.

7.1 | Method

7.1.1 | Participants and design

Seven hundred participants (394 females, 300 males, 1 non-binary and 5 not indicated, $M_{age} = 41.78$, SD = 14.28) were recruited via Amazon Mechanical Turk for a study on lie detection. The online experiment employed a 2 (uncertainty salience: uncertainty salient vs. certainty salient) × 2 (type of message: truthful vs. deceptive) × 2 (speakers' skin colour: black vs. white) × 2 (speakers' gender: female vs. male) × 2 (valence: positive vs. negative) mixed-model design. Uncertainty salience was a between-subjects factor, and all other variables were manipulated within-subjects.

We conducted an a priori power analysis using G*Power (Faul et al., 2009) with an assumed power of 90%, an alpha error probability of 0.05, and an expected effect size of $\eta_p{}^2 = 0.018$ (taken from Experiment 1). The analysis suggested a sample size of 576. We collected the data of 700 individuals to ensure sufficient power despite potential exclusions. Following the pre-registered exclusion criteria (see https://osf.io/ruz9v/), 21 participants were excluded because they failed the bot check and 54 participants (thereof 28 in the uncertainty condition and 26 in the certainty condition) because they gave unsuitable answers regarding the manipulation questions (e.g., they wrote nonsense, did not write about (un)certainty at all, or entered copied texts). Hence, the final sample consisted of 625 participants, which implied a power of 92% for the assumed effect size of $\eta_p{}^2 = 0.018$. Further, a *sensitivity power analysis* (G*Power; Faul et al., 2009) for the given sample size of $N = 142$ (correlation between repeated measures of $r = 0.116$, $\alpha = 0.05$) showed that a minimum effect size of $d = 0.16$ could be detected with a power of 80%.

7.1.2 | Stimulus material

In line with increasing the sample size of participants for this high-powered experiment, we used an even larger stimulus material (320 messages) than in the previous experiments. The stimulus material was provided by the Miami University deception detection database (Lloyd et al., 2019). The videotaped messages were generated in a laboratory study in which Black and White male and female students and staff members from the campus of Miami university participated as speakers. Each speaker recorded four messages. In the first message, they told the truth about a person they liked, followed by a message in which they talked about the same person and pretended that they disliked them. In the third message, they told the truth about a person they disliked, followed by a message in which they talked about the same person and pretended that they liked them. Participants had a maximum of 45 s for each recording and were asked to indicate why they (dis-)liked the person and had to describe their positive (negative) qualities.

Four hundred forty-eight messages were recorded from 112 speakers. Out of these, Lloyd et al. selected 20 speakers from each of the four speaker categories (i.e., Black female, Black male, White female, White male), resulting in a total of 80 speakers and 320 messages (see Lloyd et al., 2019, for more details on the material generation and selection procedure). These messages were randomly assigned to 20 sets of 16 messages. The speaker categories were counterbalanced, and each speaker appeared only once per set.

7.1.3 | Procedure

First, participants gave informed consent and stated demographic data on their age, gender, highest educational level, employment status, and whether they were located in the US and were native English speakers. As pre-registered, only native English speakers who were located in the US could further participate in the study. Participants were provided with an audio file and a test video to check whether they fulfilled the technical requirements for working on the lie detection task. Individuals who answered a control question regarding the test video wrong could not participate further in the study.

Next, participants were randomly assigned to either the uncertainty salience condition (see, e.g., Van den Bos, 2001) in which they had to imagine being *uncertain* about themselves or to the certainty salience condition in which they had to imagine being *certain* about themselves. Depending on the condition, they answered the following two questions in written form: (1) 'What emotions does the thought of you being (un)certain about yourself arouse in you?' and (2) 'What will happen physically to you as you feel (un)certain about yourself?' Participants had to work on the manipulation for at least 3 min; only after 3 min could they get to the next page.

After the manipulation, participants' positive ($\alpha = 0.92$) and negative affect ($\alpha = 0.94$) was assessed using the PANAS. The manipulation check of Experiment 1 was adjusted to assess the salience of uncertainty thoughts and certainty thoughts (both αs = 0.96) with two items each.

Participants were randomly assigned to one of the 20 sets of messages for the lie detection task. For each of the 16 messages included in the respective set, participants stated whether they thought the speaker lied or told the truth (binary judgement) and indicated how confident they were in that judgement on a percentage scale ranging from 0% to 100% in steps of 1%.

7.2 | Results

7.2.1 | Manipulation checks

A MANOVA on the uncertainty and television salience scales, intercorrelated with $r(623) = -0.27$, $p < .001$, revealed the expected effect of the manipulation at the multivariate level, $F(2, 622) = 125.14$, $p < .001$, $\eta_p^2 = 0.287$, 90% CI [0.238, 0.331]. As expected, thoughts of uncertainty were higher in the uncertainty condition than in the neutral condition and vice versa for TV salience. Further, we checked whether the uncertainty salience manipulation affected participants' mood. A MANOVA on the positive and negative affect scales, $r(623) = -0.14$, $p < .001$, revealed an effect of the manipulation at the multivariate level, $F(2, 622) = 6.09$, $p = .002$, $\eta_p^2 = 0.021$, 90% CI [0.004, 0.039], as well as at both univariate levels (see Table 1 for the univariate results and descriptive statistics of the manipulation checks). Participants in the certainty condition reported higher positive and lower negative mood compared to participants in the uncertainty condition. Therefore, possible effects of the uncertainty manipulation need to be examined while controlling for participants' mood to rule out the possibility that any effects are due to mood effects.

7.2.2 | Detection accuracy

Data were analysed by a 2 (uncertainty salience: salient vs. neutral) × 2 (message type: truthful vs. deceptive) × 2 (set of messages) mixed-model design ANOVA with detection accuracy (in %) as the dependent variable. Contrary to the hypothesis, the effect of the uncertainty manipulation was not significant, $F(1, 585) = 1.14$, $p = .285$, $\eta_p^2 = 0.002$, 90% CI [0, 0.012] (see Table 2). Participants in the uncertainty salient condition (see Table 1) were not more accurate in overall judging which messages were truths and which were lies than participants in the neutral condition, $d = 0.06$, 95% CI [−0.10, 0.22] (see Figure 6). Overall accuracy rates among participants in the certainty condition did not differ significantly from chance, $t(314) = 1.74$, $p = .083$, $d = 0.10$, 95% CI [−0.06, 0.25], whereas participants' overall accuracy rates in the uncertainty salient condition were significantly better than chance, $t(309) = 2.84$, $p = .005$, $d = 0.16$, 95% CI [0.003, 0.318]. Participants were more accurate in classifying truthful messages as true than in classifying deceptive messages as lies. The interaction of type of message and uncertainty was not significant, indicating that the hypothesized improving effect occurred neither for true nor for deceptive messages (see Figure 6). We further ran the detection accuracy analysis with both positive and negative mood as covariates. In this analysis the effect of uncertainty manipulation was still not significant, $F(1, 583) = 1.51$, $p = .219$, $\eta_p^2 = 0.003$, 90% CI [0, 0.014].

Following our pre-registration, we conducted additional analyses in which we controlled for the additional factors inherent in the material

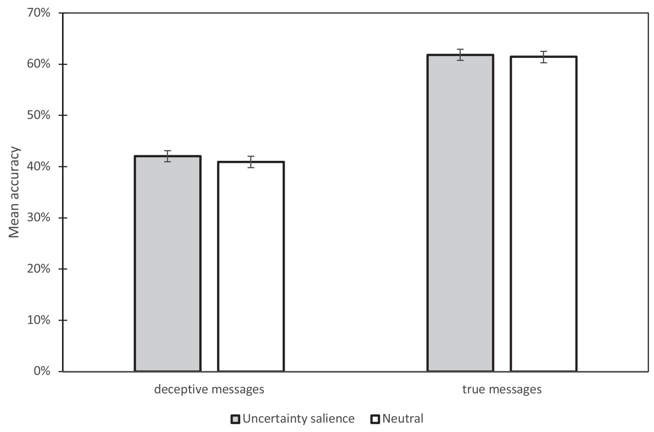

FIGURE 6 Mean detection accuracy of true and deceptive messages as a function of uncertainty in Experiment 5. Error bars indicate standard error of the mean (SEM).

(type of message, speakers' skin colour, speakers' gender, valence) by adding them as within-subjects factors to a mixed factor ANOVA with the uncertainty salience manipulation and set of messages as between-subjects factors. The effect of uncertainty was not significant in this model, too, $F(1, 585) = 1.14$, $p = .285$, $\eta_p^2 = 0.002$, 90% CI [0, 0.012]. Some unpredicted significant main and interaction effects of the control variables occurred in the model; the model results can be found in the online supplementary material.

8 | META-ANALYSES ACROSS EXPERIMENTS

All presented experiments tested the effect of uncertainty salience on the correct classification of truthful and deceptive messages (detection accuracy). A significant effect of uncertainty salience was found only in three of the five experiments, which is a likely outcome in articles with multiple studies (see, e.g., Lakens & Etz, 2017). Because the experiments differed widely in sample size and, consequently, their power, we decided to perform an internal meta-analysis across the reported experiments to determine the overall effect.

We conducted the meta-analysis in R using the robu() function from the package robumeta (Fisher et al., 2017). Across the five experiments, data were analysed from 1309 judges who collectively made a total of 19,634 judgements on a total of 464 messages from four different stimulus materials. We calculated the meta-analysis using the six effect sizes obtained for the difference in detection accuracy between the uncertainty condition and the respective control condition(s). For Experiment 2, two effect sizes were included: the difference between the uncertainty condition and the $\text{neutral}_{\text{notask}}$ condition, and the second one for the difference between the uncertainty condition and the $\text{neutral}_{\text{emails}}$ condition. We accounted for the dependency induced by including the uncertainty condition in two different effect sizes by using the correlated effects model from the robu() function. Additionally, we used the built-in small-sample correction for both the residuals and degrees of freedom (as detailed in Tipton, 2015). Note, however,

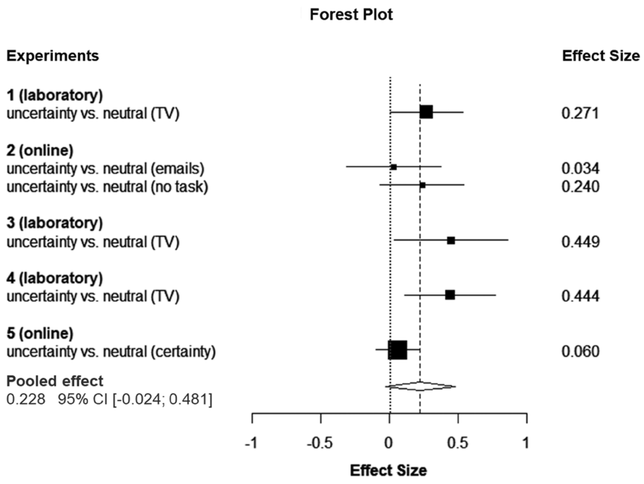

FIGURE 7 FOREST plot of the standardized mean differences for the effect of uncertainty salience on detection accuracy across the six measures obtained from Experiments 1–5.

that the number of included effect sizes in the meta-analyses was deficient; therefore, the meta-analysis results should be interpreted with caution.

The analysis yielded an overall non-significant standardized mean difference of 0.23, SE = 0.09, $t(3.48) = 2.66$, $p = .065$, 95% CI [−0.02; 0.48] (see Figure 7 for the forest plot). Because the experiments in which an effect was found were conducted in the laboratory, whereas the experiments in which no effect was found were conducted online, we examined the type of experiment (laboratory vs. online) as a possible moderator of the effect of uncertainty. The uncertainty salience manipulation might work less well online than in laboratory experiments because it requires participants to take time to think about a situation in which they felt uncertain. Participants in online studies might be exposed to more sources of distraction than participants in the laboratory. The moderator meta-analysis revealed a significant standardized mean difference between online and laboratory experiments of −0.29, SE = 0.08, $t(2.76) = -3.67$, $p = .040$, 95% CI [−0.55; −0.03]; in the laboratory, the standardized mean difference of 0.36 between the uncertainty and the neutral condition was significant, SE = 0.07, $t(1.76) = 5.02$, $p = .049$, 95% CI [0.01; 0.71]. Importantly, note that the meta-analytics results, especially the moderator analysis, should be interpreted with caution due to the small number of experiments

9 | GENERAL DISCUSSION

Five experiments using different true and deceptive messages and different motivating situations found mixed results for the effect of salience of personal uncertainty on deception detection accuracy. Based our experiments on uncertainty management models, we assumed that uncertainty motivates people to assess their social integration (e.g., Hogg, 2007; Van den Bos & Lind, 2002). Because veracity is seen as a good cue for one's closeness to another person (DePaulo & Kashy, 1998), people should be motivated to form this judgement when they feel uncertain. In turn, high cognitive motivation should lead to better veracity judgements (Reinhard, 2010). Whereas Experiments 3 and 4 found support for the predicted higher detection accuracy when personal uncertainty was salient, Experiments 2 and 5 found no support for this effect. Experiment 1 revealed only weak support as the effect of uncertainty was no longer significant when controlling for mood. Because controlling for participants' mood caused the effect of uncertainty to disappear in Experiment 1 and the uncertainty salience manipulation affected participants' mood in Experiment 5, further work on the uncertainty (salience) manipulation is needed to distinguish between mood effects (see also Reinhard & Schwarz, 2012) and the effect of personal uncertainty on lie detection accuracy.

An internal 'eta-analysis for the experiments showed an overall small effect which was not significant. The effect was larger in laboratory experiments compared to online experiments. This difference in effect sizes could be because participants in online experiments may be exposed to more sources of distraction than participants in the laboratory. This might have reduced the effectiveness of the uncertainty salience manipulation (e.g., if participants browsed the internet instead of thinking about feeling uncertain), or it might have affected participants' concentration while watching the videos (e.g., if participants did other things instead of observing the videos). Similar distractions are possible in the laboratory, but they may be stronger in online studies (see also Clifford & Jerit, 2014). Moreover, for studies with samples from Amazon Mechanical Turk as in Experiment 5, data quality can be an issue as also reflected in the discussion on appropriate attention checks and bot checks (see e.g., Chmielewski & Kucker, 2020; Jones et al., 2022; Webb & Tangney, 2022). Therefore, a more in-depth investigation and further development of the uncertainty manipulation and its effectiveness in different experimental contexts is needed.

Another explanation for the heterogeneity in effect sizes could have been participants' motivation and the personal relevance of detecting speakers' lies. Effect sizes were largest when participants selected speakers for later meetings or work tasks (Experiments 3 and 4). Hence, uncertainty may play a role especially when it is personally relevant for individuals to determine who is lying; only then might uncertainty salience increase individuals' motivation sufficiently. Further research could, therefore, investigate motivational factors as moderators of uncertainty. For example, uncertainty might affect lie detection accuracy only when veracity judgements can have consequences for the uncertain person. In other words, if uncertain individuals have the option of avoiding interactions with suspected liars, uncertainty might be more effective than if these individuals must interact with the alleged liar in all cases.

The uncertainty salience manipulation may also partially explain the mixed results. The original uncertainty salience manipulation (see Van den Bos, 2001) was intended to increase uncertainty salience without eliciting associated (negative) affective responses; thinking about it was only intended to make the construct more salient. Accordingly, the PANAS has been included as a measure of positive and negative affect in experiments using this type of manipulation, but generally did not reveal affective differences (e.g., Greifeneder et al., 2011; Müller et al., 2010; Van den Bos, 2001; Van den Bos et al., 2005).[3] Meanwhile, the manipulation check focused on the activation and salience of uncertainty. In lie detection research, increasing uncertainty salience without altering affect is particularly important, as previous research has shown effects of negative mood on lie detection accuracy (Reinhard & Schwarz, 2012). Although the (intentionally) weak uncertainty salience manipulation used previously seemed appropriate here, it may have contributed to our inability to replicate the effect consistently. Future research should focus on developing stronger manipulations that (a) do not produce affective differences between conditions, (b) do not induce information asymmetry (i.e., no informational uncertainty; see Becker & Knudsen, 2005; Lipshitz & Strauss, 1997) and (c) have a personal component (see Van den Bos & Lind, 2009).

We investigated the influence of personal uncertainty on the ability to detect deception through classic detection paradigms. Participants were explicitly asked to judge the veracity of given information. These paradigms mirror situations in which people may have some suspicion about the intention of others (such as police interviews, but perhaps also job application processes and social dating events). Examining whether uncertainty may motivate people to start the detection process in situations with no suspicion may be a further interesting research question. In other words, we argue for a closer examination of the motivational underpinnings of the deception detection process. This might ultimately lead us to understand better whether motivational factors (e.g., personal uncertainty and personal relevance) may improve lie detection accuracy after all. For uncertainty, the current findings suggest that the effect is, if at all, relatively small.

We obtained mixed results for the assumption that uncertainty salience increases participants' usage of verbal and paraverbal cues, which should result in higher lie detection accuracy. Verbal and paraverbal cues are challenging to process and therefore are likely to require more motivation, but at the same time may contain valuable information (see also DePaulo et al., 2003). Supporting this assumption, Experiment 3 revealed that self-reports about the use of verbal information mediated the effect of uncertainty on the accuracy of deception judgements. Contradicting the assumption, in Experiment 2, the uncertainty salience manipulation did not affect participants' self-reported use of verbal information. In Experiment 4, the uncertainty salience manipulation did not affect the use of the coded verbal and non-verbal cues. Even though some of the coded cues were among the most commonly stated beliefs about cues to deception (see Global Deception Research Team, 2006) and were associated with lie/truth judgements in a previous study (Reinhard, Greifeneder et al., 2013), these cues did not predict lie/truth judgements. Hence, these findings show that the processes involved in forming lie/truth judgements may be more complex than commonly assumed and that caution is required when interpreting research on cues to deception (see also Luke, 2019). Further studies should employ large samples of messages to keep the individual effects of the stimulus materials as low as possible (see Levine et al., 2022).

A small effect of uncertainty on lie detection accuracy would fit previous findings that identified cognitive and motivational variables that improve accuracy such as Need for Cognition, situational familiarity, or low task involvement (e.g., Forrest & Feldmann, 2000; Reinhard, 2010; Reinhard et al., 2011). It is in line with the literature that the effect of uncertainty on accuracy is small, if it exists at all. Numerous studies suggest that the accuracy of a veracity judgement depends less on the person making the judgement than on the stimulus being judged (e.g., Bond & DePaulo, 2008; Levine, 2016; Levine et al., 2011; Volz et al., in press). In general, judge variables that consistently predict or produce high accuracy in the literature are very rare (for meta-analyses, see Aamodt & Custer, 2006; Bond & DePaulo, 2006). Instead, there are repeatedly contradictory results, for example regarding the effect of judges' motivation on accuracy (e.g., Forrest & Feldman, 2000; Porter et al., 2007; Wu et al., 2015), resulting in discussions of potential moderators (see Wu et al., 2015). In the light of the replication crisis in psychology, the presented set of experiments shows once more the importance of publishing all conducted studies, whether significant or not. Suppose only studies with significant effects are published. In that case, essential moderators may be overlooked, or even worse, non-existing effects might be considered essential, and further research efforts may be wasted on the topic. Putting out all available evidence can help make the scientific process more efficient by allowing researchers to plan their research activities based on all available information.

The presented work extends the uncertainty management model (Van den Bos & Lind, 2002) to a new important part of social interactions, that is, lies. We examined lies as a potential cue to signal the quality of social relations under personal uncertainty to add to previously researched cues (see e.g., Hogg, 2007; Van den Bos & Lind, 2002; Van den Bos et al., 2005). Uncertainty may lead to individuals reflecting more thoroughly on how they are treated by others including whether others are honest. Importantly, however, uncertainty does not seem to lead to generally increased suspicion. We found no effect of uncertainty on participants' tendency to classify messages as lies versus as truths. Put differently, if uncertainty has an effect on lie detection accuracy without generally increasing suspicion, it may be an adaptive mechanism helping individuals to navigate the complicated social world.

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CONFLICTS OF INTEREST STATEMENT

All authors declare that they have no conflicts of interest.

[3] Note that we found an effect of the uncertainty salience manipulation on affect in Experiment 1.

DATA AVAILABILITY STATEMENT

The data of the reported experiments and the pre-registration of Experiment 5 is publicly available at: https://osf.io/ruz9v/.

ETHICS STATEMENT

All studies were conducted in accordance with the Ethical guidelines of the American Psychological Association (APA).

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