Research Article

Karl Ask*, Sofia Calderon, Erik Mac Giolla, Marc-André Reinhard

Approach, Avoidance, and the Perception of Credibility

<https://doi.org/10.1515/psych-2020-0002>

Received May 31, 2018; accepted August 30, 2019

Abstract: Based on a functional approach to credibility judgments, the authors hypothesize that receivers' judgments of senders' credibility involve an evaluative dimension (i.e., good–bad) and are associated with approach and avoidance tendencies. In three experiments (total $N = 645$), participants (receivers) judged the credibility of suspects (senders) denying involvement in a mock theft. While watching or reading the message, receivers performed an approach-related (arm flexion) or an avoidance-related (arm extension) motor action. Although receivers' affective evaluations of senders (good–bad) correlated strongly with credibility judgments in all three experiments, the results of the arm position manipulation were mixed. In Experiment 1, receivers in an arm flexion (vs. arm extension) state judged the sender as more credible, but only when informed beforehand about the upcoming credibility judgment. In Experiment 2 and 3, however, there was no evidence of an arm position effect on credibility judgments. A cross-experimental meta-analysis revealed that the effect of the manipulation was statistically indistinguishable from zero, Hedges' $g = 0.07$, 95% CI $[-0.09, 0.22]$, and provided strong support for the null hypothesis. Multiple interpretations of the results are discussed.

Keywords: credibility, approach, avoidance, deception, embodied cognition

Decades of research on credibility judgments shows that people's ability to detect lies is poor (Bond & DePaulo, 2006) and varies little as a function of individual differences (Bond & DePaulo, 2008). To better understand these findings, researchers have examined the processes involved when people make credibility judgments (e.g., Levine, 2014; Street, 2015). This research typically portrays lie detection as a strictly cognitive and dispassionate mental process, where receivers perceive and integrate behavioral cues displayed by senders during communication (Vrij, 2008).¹ However, a cognitive account of credibility judgments may only tell half the story. A growing body of research suggests that, in many situations, judgments of honesty are determined largely by variables related to the general impression of the sender (Hartwig & Bond, 2011; Levine et al., 2011). Here, we argue that rudimentary evaluative mechanisms are important elements in such processes. Specifically, we test the hypothesis that the perception of credibility involves assessments along an underlying evaluative (good–bad) dimension, and that receivers rely on rudimentary approach–avoidance tendencies as a basis for their credibility judgments.

¹ Some cognitively oriented models of deception judgments, while predominantly focused on the integration of external cues to truth/deception, acknowledge that inner subjective feelings of the perceiver may play a role. For instance, Truth Default Theory (Levine, 2014) suggests that feelings of suspicion can trigger lie detection processes, and the Adaptive Lie Detector account (Street, 2015) acknowledges feelings of confidence as a potential cue.

***Corresponding author: Karl Ask**, Department of Psychology, University of Gothenburg, Gothenburg, Sweden, E-mail: karl.ask@psy.gu.se

Sofia Calderon, Erik Mac Giolla, Department of Psychology, University of Gothenburg, Gothenburg, Sweden

Marc-André Reinhard, Department of Psychology, University of Kassel, Kassel, Germany

The Process of Credibility Attribution

The past couple of decades have seen a growing focus on process-oriented lie-detection research (e.g., Bond & DePaulo, 2006; Forrest & Feldman, 2000; Hartwig & Bond, 2011; Levine, 2014; Levine, Kim, & Blair, 2010; Masip, Garrido, & Herrero, 2009; O'Sullivan, 2003; Reinhard, 2010; Reinhard & Sporer, 2008; Reinhard, Sporer, Scharmach, & Marksteiner, 2011; Street, 2015). One important pattern of findings emerging from these efforts is that people rely on different judgment strategies depending on situational and dispositional factors. Specifically, variables that increase the likelihood of systematic elaboration, such as dispositional need for cognition (Reinhard, 2010), expertise (Blair, Levine, & Shaw, 2010; Reinhard *et al.*, 2011), and personal involvement (Forrest & Feldman, 2000; Reinhard & Sporer, 2008), increase the reliance on cues present in the content of the message (e.g., consistency, level of detail). Conversely, in the absence of motivation or capacity for systematic elaboration, credibility judgments appear to be more strongly determined by nonverbal behavior (e.g., nervousness, fidgeting) associated with the presentation of the message. The latter implies that people often form a global impression of the sender, rather than attend to individual cues present in the message (see e.g., O'Sullivan, 2003). Indeed, meta-analytic (Hartwig & Bond, 2011) and experimental (Levine *et al.*, 2011; Reinhard & Sporer, 2010) evidence shows consistently that judgments of honesty are determined largely by variables related to the general impression of the sender, such as friendliness, pleasantness, attractiveness, and cooperativeness.

Global judgments of this kind can be understood from the perspective of functional approaches to social cognition. The basic tenet of functional approaches is that “thinking is for doing” (e.g., Fiske, 1992). That is, social cognitive processes are best understood in terms of how they help us navigate and act in our social environment. A key idea within this framework is that, at a fundamental level, people process information about others primarily because they want to know whether the other is to be approached or avoided (Scholer & Higgins, 2008). For instance, people spontaneously and rapidly assess others along a warmth–coldness dimension, corresponding to information about the social goodness or badness of the individual (Abele & Wojciszke, 2007; Fiske, Cuddy, & Glick, 2007).

When applied to deception contexts, a functional approach means taking into account how the perception of honesty and deception informs an individual's future behavior. According to evolutionary communication theory, in order to maximize the profitable outcomes of social interaction and to avoid being exploited through deception, humans (and other social animals) are under the constant selection to predict the behavior of others (Andrews, 2002; Cosmides & Tooby, 2005). Hence, in ecologically valid settings, judgments of honesty and deception are made to assess the reliability of others in future social interactions. Perceived deceptiveness signals the need to avoid engaging in social interaction with the other, whereas perceived honesty signals an opportunity to approach. Given its functional relevance, the perception of credibility and honesty can be expected to involve evaluative mechanisms and be associated with rudimentary approach–avoidance tendencies.

A growing body of evidence indicates that perceptions of credibility and honesty are indeed a primary concern of the social perceiver. For instance, people tend to primarily seek and recall information about honesty (vs. sociability and competence) when forming impressions about others (Brambilla, Rusconi, Sacchi, & Cherubini, 2011; Rule, Slepian, & Ambady, 2012) and to make quick and spontaneous inferences about trustworthiness from the facial features of strangers (Todorov, Baron, & Oosterhof, 2008). The primacy and automaticity of such inferences suggest that they involve primitive evaluative systems critical to survival (Bar, Neta, & Linz, 2006). For instance, evaluative processes in the brain (i.e., amygdala activity) correlate strongly with spontaneous inferences about trustworthiness (Todorov & Engell, 2008). Moreover, there is evidence to suggest that spontaneous evaluation of face trustworthiness serves to regulate approach/avoidance behaviors towards strangers (Adolphs, Tranel, & Damasio, 1998; Fenske, Raymond, Kessler, Westoby, & Tipper, 2005; Slepian, Young, & Harmon-Jones, 2017; Todorov *et al.*, 2008). For instance, Fenske and colleagues (2005) found that faces which had, in a previous task, been associatively paired with behavioral inhibition (i.e., withholding a response), were subsequently perceived as less trustworthy than faces not associated with inhibition. Moreover, Adolphs and colleagues (1998) showed that patients with complete bilateral amygdala damage failed to display the tendency of control participants to avoid “objectively” untrustworthy faces, further underscoring the evaluative nature of trustworthiness and honesty.

Approach- and Avoidance-Related Motor Actions

A possible way to gain insight into the evaluative nature of credibility attribution is to examine the role of approach- and avoidance-related motor actions in credibility judgments. Previous research has shown that exposure to appetitive stimuli can facilitate motor responses associated with approach motivation (e.g., bringing stimuli closer to the self), whereas aversive stimuli can facilitate avoidance-related motor responses (e.g., moving stimuli away from the self; Chen & Bargh, 1999; Krieglmeier, Deutsch, De Houwer, & De Raedt, 2010; Phaf, Mohr, Rotteveel, & Wicherts, 2014; but see Rotteveel et al., 2015, for a failure to replicate the effect). More importantly, experimentally induced approach-related (vs. avoidance-related) motor actions have been found to produce more positive evaluations of concurrently perceived targets (Cacioppo, Priester, & Berntson, 1993; Friedman & Förster, 2008) and to activate approach (vs. avoidance) motivation (Centerbar & Clore, 2006; Thibodeau, 2011). While most studies have demonstrated approach–avoidance effects using simple non-social target stimuli (e.g., objects, words), Slepian, Young, Rule, Weisbuch, and Ambady (2012) found that human faces perceived as trustworthy (untrustworthy) facilitated participants' approach-related (avoidance-related) motor actions. Conversely, faces encoded while participants performed an approach-related motor action were subsequently rated as significantly more trustworthy than faces encoded during an avoidance-related motor action. More recently, Van Dessel, De Houwer, and Gast (2016) similarly found that participants evaluated faces that had been paired with an approach-related (vs. avoidance-related) motor action more positively, although only when participants were consciously aware of the relationship between the stimulus and the motor action.

In the current research, we induced motor actions using a common manipulation—isometric (i.e., motionless) muscle activation (e.g., Cacioppo et al., 1993; Thibodeau, 2011). To induce an approach-related action, participants were instructed to press the palm of their hand upward against the underside of a table, thus activating the flexor muscles in the arm and shoulder. Such isometric *arm flexion* involves the same muscles as does moving objects closer by bending the arm toward the body. To induce an avoidance-related action, participants were instructed to press the palm of their hand downward against the top of a table, thus activating the extensor muscles in the arm and shoulder. Such isometric *arm extension* involves the same muscles as does removing objects by extending the arm away from the body.²

Psychophysiological research has repeatedly provided evidence for a link between avoidance motivation and extensor motor activity in human participants (Coombes, Cauraugh, & Janelle, 2006, 2007b, 2007a; Coombes et al., 2009). Moreover, Thibodeau (2011) showed that isometric arm flexion attenuates the startle reflex (characteristic of approach motivation), whereas arm extension intensifies the startle reflex (characteristic of avoidance motivation; for similar findings, see Deuter, Best, Kuehl, Neumann, & Schächinger, 2014). In addition to the biological account, researchers have argued that the association between arm flexion/extension and approach/avoidance is a result of evaluative conditioning (Cacioppo et al., 1993). According to this view, affective and motivational states have become associatively paired with certain motor actions through repeated co-occurrence (e.g., we tend to move desired objects closer to, and undesired objects further away from, our bodies). Consistent with this notion, participants in the Cacioppo et al. (1993) study associated arm flexion significantly more strongly with approach motivation than with avoidance motivation.

Although the above research suggests a direct association between certain motor actions and approach/avoidance motivation, this notion has been somewhat modified in recent years. Specifically, research using arm flexion/extension actions as an outcome measure of responses to affective information (i.e., an *affect-to-action* mechanism) shows that the association between these actions and stimulus valence is flexible (Krieglmeier, De Houwer, & Deutsch, 2013). Thus, arm flexion and extension responses are not invariably facilitated by appetitive and aversive stimuli, respectively, but the relationship can be reversed through instruction or visual framing (e.g., by creating the illusion that arm extension brings

² Although arm extension is conceivable under approach motivation, such as when reaching for a pleasant object, the action that is temporally closest to bringing the object closer is arm flexion (Thibodeau, 2011).

stimuli closer to the participant; Eder & Rothermund, 2008; Seibt, Neumann, Nussinson, & Strack, 2008). Importantly, however, when participants use the self as a point of reference (i.e., flex the arm to bring stimuli closer), and engage in evaluative judgments of the stimuli, arm flexion is facilitated by positive stimuli and arm extension is facilitated by negative stimuli (Phaf et al., 2014). Because the current research investigates motor actions as an *antecedent* (rather than a consequence) of evaluation, research using arm flexion/extension as manipulation of affective and motivational states (i.e., action-to-affect) is more directly relevant. The published action-to-affect research largely supports the hypothesis that arm flexion induces approach motivation and that arm extension induces avoidance motivation (Cacioppo et al., 1993; Centerbar & Clore, 2006; Friedman & Förster, 2008; Slepian et al., 2012; Van Dessel et al., 2016; for an exception, see Rotteveel et al., 2015).

The Present Research

In the present research, we sought to demonstrate a similar influence on judgments of more complex and dynamic social stimuli; that is, credibility judgments of potentially deceptive messages. Given our assumption that perceptions of deception and honesty reflect a fundamental evaluation of the sender, we predicted that receivers who process a message while in an approach-related state would judge the sender as more credible than would observers who process the message while in an avoidance-related state. The present research consists of three experiments. In all experiments, participants judged the credibility of a person who either told the truth or lied in an interview, and the same manipulation of approach (arm flexion) and avoidance (arm extension) was employed. The main difference between the first two experiments was that they focused on different moderators: In Experiment 1, the proposed moderator was participants' attentional focus while watching the message, and in Experiment 2, it was the presentation mode of the message. In Experiment 3, we examined the main effect of approach- and avoidance-related motor actions through a high-powered replication study.

The data from all three experiments are available at <https://osf.io/6fqpi/>

Experiment 1

In Experiment 1, the main independent variable was the manipulation of arm flexion and arm extension, which is the most common operationalization of embodied approach- and avoidance-related embodied states in the relevant literature (e.g., Cacioppo, Priester, & Berntson, 1993; Friedman & Förster, 2008; Slepian et al., 2012). We predicted that participants who watched a message in a state of arm flexion (vs. arm extension) would judge the sender as more credible (Hypothesis 1).

In addition, we manipulated the participants' attentional focus in order to explore the contingencies under which an effect of arm position may occur. Half of the participants were instructed, before watching the message, to focus on deciding whether the sender was lying or telling the truth (*veracity focus*), whereas the other half were instructed to focus on forming an impression of the sender (*impression focus*). This is somewhat related to work on indirect lie judgments (for reviews see DePaulo & Morris, 2004; Bond, Levine, & Hartwig, 2015), which examines whether ratings of other aspects of a sender's behavior, such as ratings of ambivalence (DePaulo & Rosenthal, 1979; DePaulo, Rosenthal, Green, & Rosenkrantz, 1982), comfort (Anderson, DePaulo & Ansfield, 2002), or how hard senders are thinking (Ulatoska, 2014; Vrij, Edward & Bull, 2001), can discriminate truth tellers from liars better than direct veracity judgments. The current study, however, differs from this work in an important way: In studies examining indirect lie judgments, it is the judgment that is direct or indirect. In the current experiment, all participants were instructed to make a direct veracity judgment.

As we are unaware of any previous research examining how observers' focus, in conjunction with an arm flexion/arm extension manipulation, influence lie judgments, we approach the topic with exploratory competing hypotheses. On the one hand, it may be argued that the effect of arm position should be stronger when participants focus on the veracity of the sender (Hypothesis 2a), because

affective influences on judgments occur primarily when the affective state is perceived as relevant to the judgment at hand (Greifeneder, Bless, & Pham, 2011). On the other hand, given our proposal that credibility judgments reflect an overall evaluative assessment of the sender, it may be argued that the effect of arm position should be stronger when participants focus on the general impression of the sender (Hypothesis 2b).

Method

Participants. Participants were recruited from a pool of volunteers at the Department of Psychology at a large university in Sweden. The experiment was advertised as a study on social judgments. To determine the sample size for the experiment, a power analysis based on the most relevant estimation of the effect of arm flexion vs. arm extension on the perception of social targets (Slepian et al., 2012, Exp. 2; $r = .29$) was conducted. Because of differences in design and the complexity of our stimuli, however, we aimed for 80% power to detect a substantially smaller effect, $r = .20$, at the .05 significance level, which would require a minimum of 200 participants. To accommodate for any attrition, 212 participants were recruited for the experiment. Twelve participants were excluded—seven had misinterpreted the instructions, two knew the stimulus person, two expressed familiarity with the main hypothesis, and one was excluded due to technical problems—yielding a final sample of 200 participants. One hundred and forty were female, 58 were male, and two participants did not specify their gender. Ages ranged from 18 to 75 ($M = 28.81$, $SD = 12.01$). Participants were randomly assigned to one of four conditions in a 2 (arm position: arm flexion vs. arm extension) $\times$ 2 (focus: veracity vs. impression) between-groups design. Participants read and signed informed consent forms and received 50 SEK ($\approx$ 6 USD) as compensation for their participation.

Stimulus material. The stimulus material consisted of four videotaped interviews with two truth tellers and two liars who denied their involvement in a mock theft. The interviews lasted between 3 and 5 minutes. For the creation of the material, 65 mock suspects were recruited for a study on communication (they were not informed in advance that the experiment investigated deception). They were immersed in a scenario where two cinema tickets had ostensibly gone missing from a room where they had been, and they were therefore questioned by an interviewer about what had happened in the room.

Truth tellers were innocent of the alleged theft and truthfully told what had happened: While they were engaged in a conversation about travel experiences with a fellow participant (in fact a confederate), three events took place. First, the experimenter entered the room to retrieve a document binder. Second, the fellow participant (i.e., the confederate) left the room temporarily to answer an important phone call. Third, a female participant from an earlier session (in fact a second confederate) entered the room to get her bag, which she had left in a corner. She claimed that two cinema tickets were missing from the bag, and asked whether the sender and the first confederate had seen anyone going through her bag. Both answered in the negative and the woman left the room. The experimenter then reentered the room, explaining that because two cinema tickets had gone missing from the room, the sender and the confederate would be asked a few questions about what had happened. The mock suspect was brought to the interview in an adjacent room after having been given five minutes to prepare.

Liars were guilty of the mock theft and thus lied in the interview about what had happened in the room. In actual fact, they had been instructed to enter the room, “steal” two cinema tickets from the bag, hide the tickets somewhere on themselves (e.g., in a pocket), and then sit down and wait for the experimenter to enter the room. They had further been instructed that if someone would enter the room while they waited for the experimenter, they should not confess to stealing the tickets. Similar to the truth-telling scenario, a female participant from a previous session had entered the room, complained that two cinema tickets were missing from her bag, and asked whether the sender had seen anyone go through the bag. They were then told by the experimenter that they would be questioned about the missing cinema tickets. Liars were additionally told that they would have to lie in the interview, denying involvement in the theft, and were given a sheet of paper summarizing the events that truth tellers had genuinely experienced in the room. They were instructed to use the described events as a cover story to

conceal their involvement in the theft. They were given five minutes to prepare their cover story before being taken to the interview.

The interview protocol consisted of a series of open-ended and closed questions about what had happened in the room where the tickets had gone missing (e.g., “Can you tell me everything that happened in the room you were in?”, “You were asked about trips that you’ve been on. What kind of questions were asked?”, “How did the other person react when you described your trips?”). One male interviewer interviewed all the mock suspects. The interviewer could be heard but not seen in the video recordings. Mock suspects’ head and upper body were visible in the recording. To motivate senders to appear credible, they were offered two cinema tickets as additional compensation if they were able to convince the interviewer of their innocence.

Procedure. To introduce the manipulation of arm position, participants were informed using written instructions that they would take part in a study on the involvement of various brain regions during social judgments. Ostensibly to activate specific brain regions, they were told that they would assume a certain arm position while watching a video recording. Participants in the *arm flexion* condition were instructed to place the palm of their dominant hand against the underside of the table and press lightly upwards. Participants in the *arm extension* condition were instructed to place the palm of their dominant hand on the top of the table and press lightly downwards (Centerbar & Clore, 2006; Friedman & Förster, 2008). Pictures illustrating the correct arm position (see Supplementary Materials) were presented along with the written instructions, and the experimenter checked so that participants followed the instructions correctly.

Participants were then seated in front of a laptop computer. Participants in veracity focus condition were informed that they would watch a video clip and try to decide whether the person in the video was telling the truth or lying. Participants in the *impression focus* condition were instead informed that they would watch a video clip and try to form an impression of the person in the video. All participants were also given background information in bullet points about the events leading up to the interview which they were about to see. This information was fully in accordance with the actual procedure when the video material was created (see above).

Participants were then reminded to place their arm in the instructed position before proceeding to watch the video clip. Participants were randomly assigned to view one of four video clips; all four mock-suspects were male, two of which were lying and two of which were telling the truth. Directly after the video had finished playing, participants were instructed to relax their dominant arm and to answer questions on the screen.

Credibility judgments. Participants were asked how credible (1 = *not at all credible*, 9 = *very credible*), honest (1 = *not at all honest*, 9 = *very honest*), and sincere (1 = *not at all sincere*, 9 = *very sincere*) the person in the video seemed regarding what happened in the room. The three items were averaged into a credibility composite measure (Cronbach’s $\alpha = .89$). Participants also made a dichotomous judgment of whether the person in the video lied or told the truth, and indicated how certain they were that their dichotomous judgment was correct (1 = *very uncertain*, 9 = *very certain*). Results for the latter variable are presented in the Supplementary Materials.

Sender evaluation and participant mood. Using two bipolar scales, participants rated the extent to which they felt bad–good and negative–positive about the person in the video (−4 = *negative/bad*, 0 = *neither*, 4 = *positive/good*). A composite index representing *sender evaluation* was created by averaging the two ratings ($\alpha = .96$). Participants were also asked to rate their current mood along the dimensions bad–good, sad–happy, and uncomfortable–comfortable (−4 = *very bad/sad/uncomfortable*, 0 = *neither*, 4 = *very good/happy/comfortable*). These ratings were averaged into a composite measure of *participant mood* ($\alpha = .81$).

Control variables. To examine any unintended effects of the arm-position manipulation, participants were asked to rate how exhausting (1 = *not at all exhausting*, 9 = *very exhausting*) and comfortable (1 = *very uncomfortable*, 9 = *very comfortable*) it was to keep their arm in the instructed position. To assess whether participants conformed with the focus manipulation, participants were asked to what extent they focused on deciding whether the person in the video lied or told the truth (1 = *very low extent*, 9 = *very high extent*), and on forming a general impression of the person (1 = *very low extent*, 9 = *very high*

extent), while watching the video. Finally, participants completed the 18-item Need for Cognition Scale (NFC; Cacioppo & Petty, 1982).³

Results

Control variables. There were no statistical differences between participants in the arm flexion and arm extension conditions regarding how exhausting the arm position felt ($M = 4.22$, $SD = 2.39$ vs. $M = 4.03$, $SD = 2.22$), $t(198) = 0.58$, $p = .560$, Hedges' $g = 0.08$, 95% CI $[-0.20, 0.36]$, or how comfortable the arm position felt ($M = 4.33$, $SD = 1.20$ vs. $M = 4.17$, $SD = 1.07$), $t(198) = 1.00$, $p = .321$, Hedges' $g = 0.14$, 95% CI $[-0.14, 0.42]$. In line with the focus manipulation, participants in the veracity-focus condition reported focusing significantly more on the task of deciding whether the person in the video lied or told the truth ($M = 7.35$, $SD = 1.45$) than did those in the impression focus condition ($M = 6.13$, $SD = 1.96$), $t(198) = 5.00$, $p < .001$, $g = 0.70$, 95% CI $[0.42, 0.99]$. However, there was no significant difference in the extent to which participants in the veracity focus condition ($M = 5.91$, $SD = 2.08$) and those in the impression focus condition ($M = 6.21$, $SD = 1.83$) focused on forming a general impression of the sender, $t(198) = 1.09$, $p = .279$, Hedges' $g = 0.15$, 95% CI $[-0.12, 0.43]$.

Main analysis. A 2 (arm position: arm flexion vs. arm extension) $\times$ 2 (focus: veracity focus vs. impression focus) Analysis of Variance (ANOVA) was conducted on participants' credibility judgments. Descriptive statistics in each cell of the analysis are reported in Table 1. Although participants in the arm flexion condition rated the sender as slightly more credible ($M = 6.14$, $SD = 1.82$) than did participants in the arm extension condition ($M = 5.80$, $SD = 2.00$), the predicted main effect of arm position was not statistically significant, $F(1, 196) = 1.64$, $p = .202$, $\eta_p^2 = .008$, 90% CI $[.000, .042]$.⁴ Hence, Hypothesis 1 was not supported. The main effect of focus was also non-significant, $F(1, 196) = 0.78$, $p = .378$, $\eta_p^2 = .004$, 90% CI $[.000, .031]$. In support of Hypothesis 2, however, there was a significant Arm Position $\times$ Focus interaction, $F(1, 196) = 5.41$, $p = .021$, $\eta_p^2 = .027$, 90% CI $[.002, .074]$. Tests of simple effects showed that, in the veracity focus condition, participants in an arm flexion state rated the sender as significantly more credible than did participants in an arm extension state, $F(1, 196) = 6.51$, $p = .011$, $\eta_p^2 = .032$, 90% CI $[.004, .082]$. In the impression focus condition, the ratings by participants in an arm flexion state and an arm extension state did not differ significantly from each other, $F(1, 196) = 0.55$, $p = .461$, $\eta_p^2 = .003$, 90% CI $[.000, .028]$. These results support Hypothesis 2a (stronger effect of arm position under veracity focus) and speaks against Hypothesis 2b (stronger effect of arm position under impression focus).⁵

Exploratory analyses. A logistic regression analysis was performed on participants' dichotomous lie/truth judgments (for percentages in each group, see Table 1). The arm position and focus predictor variables, and an Arm Position $\times$ Focus interaction term, were entered simultaneously in the model. The analysis did not reveal significant main effects of arm position, $b = -0.33$, $p = .421$, OR = 0.72, 95% CI $[0.33, 1.60]$, or focus, $b = -0.25$, $p = .545$, OR = 0.78, 95% CI $[0.35, 1.73]$, or a significant Arm Position $\times$ Focus interaction, $b = 1.11$, $p = .058$, OR = 3.03, 95% CI $[0.96, 9.56]$. Hence, the proportion of truth judgments did not differ significantly as a function of the factors in the experiment.

³ The NFC measure did not predict credibility judgments or interact with the manipulations. Therefore, it was not included as a covariate in the analyses.

⁴ 90% confidence intervals are reported for η_p^2 because the effect size index can only take on positive values. Importantly, a 90% CI for η_p^2 is equivalent to a 95% CI for standardized mean differences (e.g., Hedges' g ; Steiger, 2004).

⁵ When entered as a factor in the main analysis, the main effect of truth status and its interaction with the other factors on credibility judgments were not significant. Details on the analysis are reported in the Supplementary Materials.

Table 1. Means and Standard Deviations for Main Dependent Measures as a Function of Arm Position and Focus in Experiment 1

Measure	Veracity focus		Impression focus	
	Arm flexion	Arm extension	Arm flexion	Arm extension
Judged credibility	6.57 (1.70)	5.61 (1.95)	5.71 (1.85)	5.99 (2.06)
Veracity judgment (% truth judgments)	72.0%	54.0%	52.0%	60.0%
Participant mood	2.55 (1.10)	2.05 (1.09)	2.60 (0.95)	2.31 (0.88)
Sender evaluation	1.11 (1.79)	0.45 (1.88)	0.35 (1.66)	0.67 (1.93)

Note. Numbers in brackets represent standard deviations. The credibility scale ranged from 1 to 9. The scales for participant mood and sender evaluation ranged from -4 to 4 .

Further analyses were conducted to examine the roles of self-reported mood and sender evaluation as potential mediators of the observed Arm Position $\times$ Focus interaction on credibility judgments. Credibility judgments were significantly correlated with both participant mood, $r = .19$, $p = .006$, and sender evaluation, $r = .74$, $p < .001$. Table 1 reports descriptives for each cell of the experimental design. A 2 (arm position: arm flexion vs. arm extension) $\times$ 2 (focus: veracity focus vs. impression focus) ANOVA on self-reported mood revealed a significant main effect of arm position, $F(1, 196) = 7.58$, $p = .006$, $\eta_p^2 = .037$, 90% CI [.006, .090]. Participants in the arm flexion condition reported a better mood ($M = 2.57$, $SD = 1.03$) than did participants in the arm extension condition ($M = 2.18$, $SD = 0.99$). There was no main effect of focus, $F(1, 196) = 1.25$, $p = .264$, $\eta_p^2 = .006$, 90% CI [.000, .037], or Arm Position $\times$ Focus interaction, $F(1, 196) = 0.56$, $p = .456$, $\eta_p^2 = .003$, 90% CI [.000, .028], on participants' mood. A similar ANOVA was performed on participants' sender evaluations. There were no significant main effects of arm position, $F(1, 196) = 0.44$, $p = .509$, $\eta_p^2 = .002$, 90% CI [.000, .026], or focus, $F(1, 196) = 1.10$, $p = .295$, $\eta_p^2 = .006$, 90% CI [.000, .035]. Moreover, the Arm Position $\times$ Focus interaction was not statistically significant, $F(1, 196) = 3.64$, $p = .058$, $\eta_p^2 = .018$, 90% CI [.000, .060].

A mediation analysis was conducted using the PROCESS macro for SPSS (Hayes, 2018; Model 4) with the Arm Position $\times$ Focus interaction as the independent variable, judged credibility as dependent variable, and self-reported mood as proposed mediator. Bootstrapping based on 10,000 resamples showed that the indirect effect via self-reported mood was not statistically significant, $b = 0.04$, 95% BCa CI $[-0.06, 0.15]$. A corresponding analysis, with sender evaluation as proposed mediator, showed that the indirect effect via sender evaluation was also not statistically significant, $b = 0.38$, 95% BCa CI $[-0.02, 0.77]$. It should be noted, however, that these non-significant results do not provide strong evidence for the complete absence of indirect effects, as the current experiment had inadequate power to detect indirect effects where any of the constituent paths (i.e., from the independent variable to the mediator and from the mediator to the dependent variable) is small (Fritz & MacKinnon, 2007).

Discussion

Experiment 1 did not provide support for the main hypothesis that receivers performing arm flexion (vs. arm extension) would perceive senders overall as more credible (Hypothesis 1). However, the results were consistent with the prediction that the effect of arm position would be stronger when receivers focus on the task of assessing veracity (vs. impression focus; Hypothesis 2a). Consequently, the results were incompatible with the alternative prediction of Hypothesis 2b (i.e., stronger effect under impression focus). This finding is congruent with previous research on affect and cognition, showing that affective influences on judgments are more likely when the current affective state is perceived as relevant to the judgment at hand and when the judgment is the subject of attentional focus (Greifeneder et al., 2011). Alerting participants to the upcoming veracity judgment (i.e., the veracity-focus condition) should have increased the perceived relevance of their embodied state and brought the credibility judgment into their attentional focus when encoding of message. Participants in the impression focus condition, in contrast, likely attended to credibility concerns only after encoding the message, when a veracity judgment was requested. It should be noted, however,

that we did not obtain any data on participants' attentional focus or perceived relevance of their embodied state. Hence, there is currently no direct evidence that the relevance/focus account accurately describes the processes underlying the observed results.

Although Experiment 1 showed that sender evaluation was strongly correlated with credibility judgments, there was no convincing evidence that sender evaluation served as a mediator of the effect of arm position on credibility judgments. This, together with the fact that the arm-position effect was observed only under specific conditions (i.e., veracity focus), calls for further studies aiming to replicate the basic effect and to look closer at its underlying mechanisms.

Experiment 2

Experiment 2 was designed to further examine the boundary conditions of the effect of approach- and avoidance-related embodied states on credibility judgments. As in Experiment 1, participants were presented with a message while performing arm flexion (approach) or arm extension (avoidance). To maximize the likelihood of observing an effect of arm position, all participants in Experiment 2 were informed about the upcoming credibility judgment before encoding the message—mimicking the veracity-focus condition of Experiment 1. The main hypothesis was, again, that receivers performing arm flexion would judge the sender as more credible than would receivers performing arm extension (Hypothesis 1). To further investigate the mechanisms behind the arm-position effect, participants received the message in one of three presentation modes: *audiovisual* (video with sound), *visual* (video without sound), or *text* (a verbatim transcript of the message). The different presentation modes provided participants with different types and amount of information relevant to their credibility judgments, ranging from nonverbal information only (visual) to verbal information only (text), with the audiovisual condition falling between the extremes.

Previous theorizing and research uniformly point to a relationship between message presentation modality and receivers' mode of information processing. First, research on *visual dominance* has shown that the human brain processes visual information with higher priority, less effort, and greater speed compared with verbal information (Way & Masters, 1996). Moreover, visual information is automatically and effortlessly processed in the amygdala (Barry, 2005)—a brain region strongly implicated both in spontaneous evaluations of facial trustworthiness (Todorov & Engell, 2008) and in rapid affective experience (Ledoux, 1989). Second, compared with text presentations, (audio)visual presentations draw receivers attention toward more easily processed nonverbal sender characteristics and, at the same time, divert attention from more effortfully processed verbal content (Jakob, Roessing, & Petersen, 2016; Stiff & Mongeau, 2016). Third, written presentations provide greater opportunity for message elaboration than audio presentations (Braverman, 2008) and make systematic message processing more likely, whereas the audio and video modes encourage the use of peripheral or heuristic cues (Booth-Butterfield & Gutowski, 1993). Taken together, the above research suggests that receiving a message through the visual channel should encourage low-intensity, heuristic processing of the message; receiving the message through the text mode, in contrast, should encourage high-intensity, systematic processing of the verbal message content.

Because affective inputs influence judgments more strongly under heuristic, low-intensity processing than under systematic, high-intensity processing (Greifeneder et al., 2011), it was predicted that the manipulation of arm flexion (approach) and arm extension (avoidance) would exert the strongest effect on credibility judgments when messages were presented in the visual mode (Hypothesis 3a). Conversely, based on the same logic, the smallest effect of the arm-position manipulation was predicted for the text condition (Hypothesis 3b).

Method

Participants. Similar to Experiment 1, a power analysis was performed to determine the sample size required to achieve 80% power to detect a main or interaction effect of $r = .20$ at the $\alpha = .05$ level. The required sample size was 244. Two hundred and fifty-two participants were recruited for the experiment from a research participant pool at a large university in Sweden. Fourteen participants were excluded prior to analyses—seven misinterpreted the instructions, six were familiar with the study's main hypothesis, and one had an injured arm—yielding a final sample size of 238. Participants' age ranged from 18 to 76 ($M = 26.67$, $SD = 9.24$). One hundred and seventy-two were female, sixty-five were male, and one person did not specify their gender. Participants were randomly assigned to one of the six experimental conditions in a 2 (arm position: arm flexion vs. arm extension) $\times$ 3 (presentation mode: visual vs. audiovisual vs. text) between-groups design. Participants read and signed informed consent forms and received 50 SEK ($\approx$ 6 USD) as compensation for their participation.

Procedure. The procedure for Experiment 2 was identical to that in Experiment 1, with the following exceptions. Before watching or reading the message, all participants received the instructions given to participants in the veracity-focus condition of Experiment 1; that is, they were asked to focus on whether the person interviewed was lying or telling the truth. Moreover, as manipulation of presentation mode, participants watched a video recording of the message with sound (*audiovisual condition*), watched a video recording with no sound (*visual condition*), or read a verbatim text transcript of the message (*text condition*). Participants watched or read one of eight messages, randomly sampled from the same stimulus material as in Experiment 1 (messages used in Experiment 1 were not used in Experiment 2). Four of the senders were truth-tellers and four were liars, and half of the senders were female.

Measures. Judged credibility was measured using the same three items as in Experiment 1 and was averaged into a credibility composite scale ($\alpha = .89$). The measures of participant mood ($\alpha = .86$), sender evaluation ($\alpha = .95$), and how exhausting and comfortable the arm position was perceived were also identical to Experiment 1. For exploratory purposes, participants' general impression of the sender was assessed; participants were asked to rate on 9-point Likert scales (ranging from -4 to $+4$) how they perceived the sender along the dimensions cold–warm, unintelligent–intelligent, incompetent–competent, unfriendly–friendly, unskilled–skilled, and unpleasant–pleasant. Moreover, participants made a dichotomous judgment of the message's veracity with a corresponding confidence judgment, similar to Experiment 1. Results for the sender-impression and confidence judgments are presented in the Supplementary Materials.

Results

Control variables. Participants in the arm flexion and arm extension conditions did not differ significantly in terms of how exhausting the arm position was perceived to be ($M = 4.03$, $SD = 2.09$ vs. $M = 4.03$, $SD = 2.26$), $t(236) = 0.01$, $p = .992$, Hedges' $g = 0.01$, 95% CI $[-0.25, 0.26]$. Similarly, no significant difference was observed regarding how comfortable the arm position was perceived to be ($M = 4.30$, $SD = 1.40$ vs. $M = 4.43$, $SD = 1.38$), $t(236) = 0.76$, $p = .448$, Hedges' $g = 0.10$, 95% CI $[-0.16, 0.35]$.

Main analysis. A 2 (arm position: arm flexion vs. arm extension) $\times$ 3 (presentation mode: visual vs. audiovisual vs. text) ANOVA was conducted on participants' credibility judgments. Table 2 shows means and standard deviations in each cell of the analysis. There was no significant main effect of arm position, $F(1, 232) = 0.04$, $p = .84$, $\eta_p^2 < .001$, 90% CI $[-.000, .007]$, or Arm Position $\times$ Presentation Mode interaction, $F(2, 232) = 0.57$, $p = .564$, $\eta_p^2 = .005$, 90% CI $[-.000, .024]$. Hence, there was no support for Hypothesis 1 or 3. Instead there was an unexpected significant main effect of presentation mode, $F(2, 232) = 11.75$, $p < .001$, $\eta_p^2 = .092$, 90% CI $[-.038, .150]$. As indicated by Bonferroni-corrected post-hoc tests, participants in the *visual* condition rated the sender as significantly less credible ($M = 4.57$, $SD = 1.91$) than did participants in the *text* condition ($M = 5.39$, $SD = 1.83$; $p = .021$) and the *audiovisual* condition ($M = 6.05$, $SD = 2.01$; $p < .001$). The text

and audiovisual conditions did not differ significantly from each other, $p = .095$.⁶

Exploratory analyses. For exploratory purposes, a logistic regression analysis was performed on participants' dichotomous lie/truth judgments (for percentages in each group, see Table 2). First, the presentation mode variable was coded into two dummy variables with the visual condition as reference category. Next, the arm position variable, the two presentation-mode variables, and two Arm Position $\times$ Presentation Mode interaction terms, were entered simultaneously in the model. The main effect of arm position was not statistically significant, $b = -0.07$, $p = .876$, OR = 0.93 95% CI [0.37, 2.35]. In line with the above analysis of credibility judgments, however, there were significant effects of membership in the text condition, $b = 0.92$, $p = .045$, OR = 2.51, 95% CI [1.02, 6.20], and the audiovisual condition, $b = 1.35$, $p = .004$, OR = 3.86, 95% CI [1.53, 9.75]. Hence, participants watching a visual-only message made significantly fewer truth judgments (34.2%) than did participants in the text (56.3%) and audiovisual (65.8%) conditions. The interaction terms between arm position and text presentation, $b = -0.03$, $p = .966$, OR = 0.97, 95% CI [0.27, 3.51], and between arm position and audiovisual presentation, $b = -0.08$, $p = .909$, OR = 0.93, 95% CI [0.25, 3.45], were not statistically significant.

Table 2. Means and Standard Deviations for Main Dependent Measures as a Function of Arm Position and Presentation Mode in Experiment 2

Arm position	Presentation mode		
	Visual	Audiovisual	Text
Judged credibility			
Arm flexion	4.45 (1.99)	6.26 (2.04)	5.38 (2.05)
Arm extension	4.69 (1.83)	5.85 (1.98)	5.40 (1.62)
Veracity judgment (% truth judgments)			
Arm flexion	33.3%	64.1%	55.0%
Arm extension	35.0%	67.5%	57.5%
Participant mood			
Arm flexion	1.49 (1.45)	1.68 (1.57)	1.11 (1.53)
Arm extension	1.33 (1.35)	1.53 (1.34)	1.24 (1.41)
Sender evaluation			
Arm flexion	0.36 (1.99)	0.71 (1.99)	-0.45 (1.54)
Arm extension	0.16 (2.13)	0.59 (1.82)	-0.70 (1.21)

Note. Numbers in brackets represent standard deviations.

Two additional 2 (arm position: arm flexion vs. arm extension) $\times$ 3 (presentation mode: visual vs. audiovisual vs. text) ANOVAs were conducted on participants' self-reported mood and sender evaluation. Means and standard deviations are reported in Table 2. The analysis of participant mood did not reveal a main effect of arm position, $F(1, 232) = 0.08$, $p = .772$, $\eta_p^2 < .001$, 90% CI [.000, .013], a main effect of presentation mode, $F(2, 232) = 1.77$, $p = .173$, $\eta_p^2 = .015$, 90% CI [.000, .045], or an Arm Position $\times$ Presentation Mode interaction, $F(2, 232) = 0.25$, $p = .777$, $\eta_p^2 = .002$, 90% CI [.000, .014]. The analysis of sender evaluation also did not indicate a significant main effect of arm position, $F(1, 232) = 0.65$, $p = .423$, $\eta_p^2 = .003$, 90% CI [.000, .025], or an Arm Position $\times$ Presentation Mode interaction, $F(2, 232) = 0.03$, $p = .973$, $\eta_p^2 < .001$, 90% CI [.000, .006], but did reveal a significant main effect of presentation mode, $F(2, 232) = 9.51$, $p < .001$, $\eta_p^2 = .076$, 90% CI [.026, .130]. Post-hoc tests (Bonferroni) showed that participants who read the message as text reported significantly

⁶ When entered as a factor in the main analysis, the main effect of truth status on credibility judgments was not significant, but the interaction with arm position was. Importantly, the nature of the findings reported in the Results remains unchanged with and without truth status as an additional factor. Details on the analysis are reported in the Supplementary Materials.

more negative evaluations of the sender ($M = -0.58$, $SD = 1.38$) than did participants in the audiovisual ($M = 0.65$, $SD = 1.89$; $p < .001$) and the visual ($M = 0.26$, $SD = 2.05$; $p = .012$) conditions. Participants in the audiovisual and visual conditions did not differ significantly from each other, $p = .541$. As in experiment 1, sender evaluation was substantially correlated with credibility judgments, $r = .56$, $p < .001$. Participant mood, however, was not related to credibility judgments, $r = -.03$, $p = .699$.

Discussion

Again, we found no support for the main hypothesis that receivers performing arm flexion (vs. arm extension) would judge the sender as more credible (Hypothesis 1). Moreover, the arm-position effect did not differ as a function of the mode in which the message was presented, failing to support Hypothesis 3a and 3b. It could be argued, however, that only the audiovisual condition of the current experiment displayed sufficient similarity to Experiment 1 that one would expect similar findings. However, even when isolating the audiovisual condition, the arm position effect was not present, Hedges' $g = 0.20$, 95% CI $[-0.24, 0.65]$. Hence, we must conclude that the current experiment failed to replicate the previously observed arm-position effect.

We had not predicted a main effect of presentation mode but found that receivers who watched the message with only visual information perceived the sender as less credible than did receivers who received audiovisual information and those who read a text transcript of the message. As the experiment was not designed to examine this effect, the finding should be interpreted with caution. Possibly, participants in the visual condition were hesitant to attribute credibility as they lacked information about what the sender was saying, instead defaulting to rather conservative credibility judgments. Another possibility is that the sender, as a result of the reduced perceptual detail, appeared more psychologically distant in the visual condition than in the audiovisual condition. The latter explanation would fit with previous research showing that senders who are more psychologically distant, or presented in a less vivid manner, tend to come across as less credible (Landström, Granhag, & Hartwig, 2005). This account, however, begs the question why the sender was not considered even less credible in the text condition, where no perceptual details were present at all. Possibly, the text condition did not violate receivers' expectations to the same extent as the visual condition. When watching a video recording, one would typically expect it to be accompanied by auditory information; when reading a text, however, one would typically not expect additional sensory information.

Experiment 3

Taken together, the results thus far provide only limited support for the main hypothesis that observers who receive a message in an approach-related state (arm flexion) would judge the communication as more honest than observers in an avoidance-related (arm extension) state. The only result in support of this position was found among participants in Experiment 1 who were instructed to focus on deciding whether the person in the video was lying or telling the truth (*veracity focus*). In order to assess the reliability of this finding, we conducted Experiment 3 as a high-powered replication attempt.

Method

Participants. The sample size for the experiment was determined by a power analysis with the aim to achieve 80% power to detect an effect of $r = .20$ at the $\alpha = .05$ level. The analysis indicated a total sample of 200 participants. To allow for potential attrition, 227 participants were recruited from the research participant pool at a large university in Sweden. Before data analyses, twenty participants were excluded—five experienced technical problems, five were familiar with the purpose of the study, five misunderstood the instructions, three were not proficient in Swedish, one experienced the arm position as very uncomfortable, and one knew the person in the video clip. In the final sample of 207 participants, 150 were female, 56 were male, and one did not specify their gender. Ages ranged between 19 and 63 ($M = 26.96$, $SD = 7.84$). The

experiment used a simple two-group experimental design, and participants were randomly assigned to the arm-flexion or the arm-extension group.

Procedure. The procedure was identical to that in the *veracity focus* condition in Experiment 1. In the current experiment, participants watched one of eight male senders, half of which were telling the truth and half of which were lying. The senders were randomly selected from the same stimulus material as in Experiment 1 and 2, but had not been presented to participants in the previous experiments. The same measures of credibility ($\alpha = .90$), participant mood ($\alpha = .78$), sender evaluation ($\alpha = .93$), and other control variables were collected as in Experiment 1.⁷

Results

Control variables. Participants in the arm-flexion and arm-extension conditions did not differ significantly in how exhausting the arm position was perceived to be ($M = 4.63$, $SD = 2.04$ vs. $M = 4.36$, $SD = 2.08$), $t(205) = 0.93$, $p = .355$, $g = 0.13$, 95% CI $[-0.14, 0.40]$, or in how comfortable the arm position was perceived to be ($M = 4.11$, $SD = 1.22$ vs. $M = 4.26$, $SD = 1.17$), $t(205) = 0.94$, $p = .348$, $g = 0.13$, 95% CI $[-0.14, 0.41]$.

Main analysis. There was no significant difference in judged credibility between participants in the arm-flexion condition ($M = 5.97$, $SD = 1.94$) and arm-extension condition ($M = 5.95$, $SD = 1.88$), $t(205) = 0.06$, $p = .950$, $g = 0.01$, 95% CI $[-0.27, 0.28]$. Hence, there was no support for Hypothesis 1.⁸

Exploratory analyses. For exploratory purposes, a chi-square test of independence was conducted on participants' dichotomous truth/lie judgments. The analysis revealed that the proportion of truth judgments in the arm-flexion condition (55.8%) and the arm-extension condition (62.1%) did not differ significantly from each other, $\chi^2(1, N = 207) = 0.87$, $p = .352$, $\phi = .065$.

Additional analyses were conducted on participants' self-reported mood and sender evaluation. There were no significant differences between participants in the arm-flexion and arm-extension conditions in terms of mood ($M = 1.32$, $SD = 1.32$ vs. $M = 1.46$, $SD = 1.20$), $t(205) = 0.78$, $p = .439$, $g = 0.11$, 95% CI $[-0.17, 0.38]$, or in terms of sender evaluation ($M = 0.46$, $SD = 1.78$ vs. $M = 0.71$, $SD = 1.69$), $t(205) = 1.04$, $p = .298$, $g = 0.14$, 95% CI $[-0.13, 0.42]$. However, both participant mood, $r = .21$, $p = .003$, and sender evaluation, $r = .62$, $p < .001$, were significantly correlated with credibility judgments.

Discussion

The finding from Experiment 1, that participants performing arm flexion (vs. arm extension) would judge senders as more credible when instructed to focus on judging the truthfulness of the message, failed to replicate in Experiment 3. This further weakens the existing evidence for the hypothesis that embodied approach and avoidance, as operationalized in the current research, influences the perception of credibility.

Meta-analytic summary

Because the three experiments produced somewhat inconsistent findings regarding the effect of arm position on credibility judgments, we performed a cross-experimental meta-analysis to obtain a more precise estimate of the underlying effect size. For Experiment 1 and Experiment 2, we entered a separate effect size for each level of the proposed moderator variables (i.e., focus and presentation mode, respectively), resulting in a total of six effect sizes. As the arm position manipulation was identical across

⁷ Again, the NFC measure was excluded from the analyses because it did not predict credibility judgments or interact with the manipulations.

⁸ Truth status did not predict credibility judgments or interact with the arm position manipulation. Details on the analysis are reported in the Supplementary Materials.

the experiments, and because the arm flexion/arm extension manipulation is a standard manipulation of approach–avoidance states in the literature, we chose a fixed-effect model for the analysis. The results of the meta-analysis are displayed in Figure 1. The meta-analytic effect-size estimate was very small with a confidence interval overlapping zero, Hedges' $g = 0.07$, 95% CI $[-0.09, 0.22]$, indicating that the effect of arm flexion vs. arm extension on credibility judgments is negligible or non-existent. To estimate the strength of evidence in support of the null hypothesis, we also calculated a meta-analytic Bayes factor (BF) using the approach outlined by Rouder and Morey (2011), with the BayesFactor package in R (R Core Team, 2017). The BF_{01} was 13.49, suggesting that these data are over 13 times more likely to be observed under the null hypothesis than under the alternative hypothesis.

Figure 1. Meta-analytic summary of the observed effects of arm flexion vs. arm extension across experiments. Error bars and numbers in brackets represent 95% confidence intervals.

General Discussion

We predicted that motor actions posited to be associated with approach (arm flexion) and avoidance (arm extension) would influence the receiver's judgments of senders' credibility. Specifically, based on a functional perspective of cognition (Fiske et al., 2007), and on past research on impression formation (Slepian et al., 2012), we predicted that participants who engaged in arm flexion would rate senders as more truthful than participants engaged in an arm extension. Our results did not support this prediction. Across three experiments, we found little-to-no effect of arm position on credibility judgments. Based on the meta-analytic effect size across the three studies, we can confidently rule out all but a very small effect of the current approach–avoidance manipulation on credibility judgments.

A possible explanation for the null-findings concerns the complexity of our stimulus material. Previous research demonstrating a relationship between embodied approach–avoidance states and social judgments

typically avails of materials with limited complexity (e.g., Cacioppo et al., 1993; Centerbar & Clore, 2006; Slepian et al., 2012). For example, in the study by Slepian et al. (2012), participants viewed still pictures of faces and made rapid judgments while engaging in arm flexion or arm extension. In contrast, participants in the current study judged video-recorded statements varying in length between 3 and 5 minutes. It may be that embodied approach and avoidance states influence initial and more automatic impressions, but fail to influence judgments of more complex stimuli viewed over a longer period. As more information is made available over time, more deliberative processes may amend initial evaluative judgments. This would be consistent with cognitive perspectives of deception detection, which suggest that credibility judgments are based on a combination of different cues (Vrij, 2008).

Related to the previous point, people are particularly vigilant to changes in the internal and external environment (Olson & Janes, 2002), and it has been argued that affective states exert a stronger influence on cognitive processes when there is a change in the intensity or valence of feelings, rather than under prolonged periods of constant feelings (Schwarz, 2012). This further suggests that the effect of induced approach–avoidance states on social judgments may be rather transient. Future research could examine this explanation by having participants judge the credibility of messages varying in complexity and length, while engaging in approach- and avoidance-related motor actions.

Another potential explanation for the null findings is that the arm-position manipulation was too weak to produce any meaningful effect on credibility judgments over and above the impression created by senders' demeanor. Deception-detection research has shown that some senders simply come across as much more believable than others (Levine et al., 2011). Moreover, such individual differences strongly affect receivers' credibility judgments (Bond & DePaulo, 2008). To eliminate individual variability in demeanor as a source of error, Slepian et al. (2012) used images of faces selected to be neutral in terms of trustworthiness. In the current study, however, no such selection was made. People's inherent variation in terms of credibility may, therefore, have overshadowed any effect of the arm-position manipulation. In future research, it may be worthwhile testing the current hypothesis using materials where the baseline trustworthiness of senders is held constant. However, given that the current research estimated a near-zero overall effect size with considerable precision, it is unlikely that sizable effects would emerge even from such a setup.

Due to our choice of longer, more complex, materials, we had each participant view only one video. In order to increase reliability, person perception studies regularly have participants make multiple judgments. We chose only one video per participant because we were concerned that the effect of the arm-position manipulation would diminish over time; in fact, we are not aware of any previous studies demonstrating such effects using prolonged stimuli. It was not an option to use brief video clips, typical of the “thin slices” paradigm (Ambady, 2010), to allow for more judgments, because our focus was on judgments of stimuli typical of the traditional lie-detection paradigm (i.e., longer and more content-rich stimuli). Although our single-judgment approach inevitably produces more noisy observations than would a multiple-judgment approach, we would like to highlight the narrow confidence interval of the weighted average effect size in our meta-analytic summary. It indicates that our null findings cannot easily be dismissed as a product of imprecise and noisy measures.

In recent years, researchers have reported failures to replicate previous findings that embodied states influence evaluative judgments (Wagenmakers et al., 2016) and that affective stimuli predispose perceivers to approach–avoidance tendencies (Rotteveel et al., 2015). Moreover, there is some controversy about the extent to which the link between approach–avoidance and affective evaluation is automatic or subject to conscious control (Phaf et al., 2014). The available evidence indicates that the link between evaluation and arm flexion/arm extension is strongest when people are explicitly instructed to evaluate the valence of the stimuli at hand (Phaf et al., 2014) and when participants think of the motor actions as evaluatively valenced (Eder & Rothermund, 2008; Seibt et al., 2008). This may have implications for the possibility of observing approach–avoidance effects on credibility judgments. It may be that the effect occurs only when receivers construe the judgment task as an explicit evaluation of the message, and think of arm flexion and arm extension as approach- and avoidance-related movements, respectively. It is not clear whether this was true of participants in the current research, and the role of evaluative instructions should therefore be explored

in future research. On a broader scale, the present results suggest, in conjunction with findings that the relationship between motor actions and affective evaluation is complex and malleable, that it would be worthwhile to examine the robustness of results indicating direct evaluative effects of mere arm flexion and extension (e.g., Slepian et al., 2012) through large-scale replication attempts.

In conclusion, although previous research has shown that embodied approach- and avoidance-related states can influence perceivers' judgments of static social stimuli, the current research indicates that the effect may not generalize to judgments of more complex and dynamic stimuli. It should be noted, however, that these findings do not invalidate the assumption that credibility judgments are intimately tied to people's evaluations of others, as would be predicted from a functional perspective on social cognition (Fiske, 1992; Scholer & Higgins, 2008). Indeed, in the current experiments, sender evaluation consistently displayed a substantial correlation with credibility judgments. It is possible that other methodological approaches, including an alternative operationalization of approach–avoidance motivation and more explicitly evaluative instructions, are necessary to demonstrate the causal impact of approach–avoidance motivation on credibility judgments. Our three experiments, however, provide convincing evidence that such an effect is unlikely to emerge when studied under the current paradigm.

Acknowledgments: The authors would like to thank Malin Joleby and Maria Gröndal for their assistance with data collection.

Conflict of interest: The authors report no conflict of interest.

Financial support: This research was supported by a grant from Riksbankens Jubileumsfond (grant nr. P13-1103:1) to the first author.

Ethics statement: This study was carried out in accordance with the research ethical principles issued by the Swedish Research Council. All participants gave written informed consent in accordance with the declaration of Helsinki.

Supplemental Material: The online version of this article: (DOI: 10.1515/psych-2020-0002) offers supplementary material.

References

- Abele, A. E., & Wojciszke, B. (2007). Agency and communion from the perspective of self versus others. *Journal of Personality and Social Psychology*, 93, 751–763. doi: 10.1037/0022-3514.93.5.751
- Adolphs, R., Tranel, D., & Damasio, A. R. (1998). The human amygdala in social judgment. *Nature*, 393(6684), 470–474. doi: 10.1038/30982
- Anderson, D. E., DePaulo, B. M., & Ansfield, M. E. (2002). The development of deception detection skill: A longitudinal study of same-sex friends. *Personality and Social Psychology Bulletin*, 28, 536–45.
- Andrews, P. W. (2002). The influence of postreliance detection on the deceptive efficacy of dishonest signals of intent: Understanding facial clues to deceit as the outcome of signaling tradeoffs. *Evolution and Human Behavior*, 23, 103–121. doi: 10.1016/S1090-5138(01)00084-8
- Bar, M., Neta, M., & Linz, H. (2006). Very first impressions. *Emotion*, 6, 269–278.
- Barry, A. M. (2005). Perception theory. In K. Smith, S. Moriarty, G. Barbatsis, & K. Kenney (Eds.), *Handbook of visual communication research: Theory, methods, and media* (pp. 45–62). Mahwah, NJ: Erlbaum.
- Blair, J. P., Levine, T. R., & Shaw, A. S. (2010). Content in context improves deception detection accuracy. *Human Communication Research*, 36, 423–442. doi: 10.1111/j.1468-2958.2010.01382.x
- Bond, C. F., & DePaulo, B. M. (2006). Accuracy of deception judgments. *Personality and Social Psychology Review*, 10, 214–234. doi: 10.1207/s15327957pspr1003_2
- Bond, C. F., & DePaulo, B. M. (2008). Individual differences in judging deception: Accuracy and bias. *Psychological Bulletin*, 134, 477–492. doi: 10.1037/0033-2909.134.4.477
- Bond, C. F. Jr., Levine, T. R., & Hartwig, M. (2015). New findings in nonverbal lie detection. In P. A. Granhag, A. Vrij, & B. Verschuere (Eds.), *Deception detection: Current challenges and new directions* (pp. 37–58). Chichester, UK: Wiley.

- Booth-Butterfield, S., & Gutowski, C. (1993). Message modality and source credibility can interact to affect argument processing. *Communication Quarterly*, 41, 77–89. doi: 10.1080/01463379309369869
- Brambilla, M., Rusconi, P., Sacchi, S., & Cherubini, P. (2011). Looking for honesty: The primary role of morality (vs. sociability and competence) in information gathering. *European Journal of Social Psychology*, 41, 135–143. doi: 10.1002/ejsp.744
- Braverman, J. (2008). Testimonials versus informational persuasive messages: The moderating effect of delivery mode and personal involvement. *Communication Research*, 35, 666–694. doi: 10.1177/0093650208321785
- Cacioppo, J. T., & Petty, R. E. (1982). The need for cognition. *Journal of Personality and Social Psychology*, 42, 116–131. doi: 10.1037/0022-3514.42.1.116
- Cacioppo, J. T., Priester, J. R., & Berntson, G. G. (1993). Rudimentary determinants of attitudes: II. Arm flexion and extension have differential effects on attitudes. *Journal of Personality and Social Psychology*, 65, 5–17. doi: 10.1037/0022-3514.65.1.5
- Chen, M., & Bargh, J. A. (1999). Consequences of automatic evaluation: Immediate behavioral predispositions to approach or avoid the stimulus. *Personality and Social Psychology Bulletin*, 25, 215–224. doi: 10.1177/0146167299025002007
- Cosmides, L., & Tooby, J. (2005). Neurocognitive adaptations designed for social exchange. In D. M. Buss (Ed.), *The handbook of evolutionary psychology* (pp. 584–627). New York: Wiley.
- Centerbar, D. B., & Clore, G. L. (2006). Do approach-avoidance actions create attitudes? *Psychological Science*, 17, 22–29. doi: 10.1111/j.1467-9280.2005.01660.x
- Coombes, S. A., Cauraugh, J. H., & Janelle, C. M. (2006). Emotion and movement: Activation of defensive circuitry alters the magnitude of a sustained muscle contraction. *Neuroscience Letters*, 396, 192–196. doi: 10.1016/j.neulet.2005.11.048
- Coombes, S. A., Cauraugh, J. H., & Janelle, C. M. (2007a). Dissociating motivational direction and affective valence: Specific emotions alter central motor processes. *Psychological Science*, 18, 938–942. doi: 10.1111/j.1467-9280.2007.02005.x
- Coombes, S. A., Cauraugh, J. H., & Janelle, C. M. (2007b). Emotional state and initiating cue alter central and peripheral motor processes. *Emotion*, 7, 275–284. doi: 10.1037/1528-3542.7.2.275
- Coombes, S. A., Tandonnet, C., Fujiyama, H., Janelle, C. M., Cauraugh, J. H., & Summers, J. J. (2009). Emotion and motor preparation: A transcranial magnetic stimulation study of corticospinal motor tract excitability. *Cognitive, Affective, & Behavioral Neuroscience*, 9, 380–388. doi: 10.3758/CABN.9.4.380
- DePaulo, B. M., & Morris, W. L. (2004). Discerning lies from truths: Behavioral cues to deception and the indirect pathway of intuition. In P. A. Granhag & L. A. Strömwall (Eds.), *The detection of deception in forensic contexts* (pp. 15–40). New York, NY: Cambridge University Press.
- DePaulo, B. M., & Rosenthal, R. (1979). Telling lies. *Journal of Personality and Social Psychology*, 37, 1713–22.
- DePaulo, B. M., Rosenthal, R., Green, C. R., & Rosenkrantz, J. (1982). Diagnosing deceptive and mixed messages from verbal and non-verbal cues. *Journal of Experimental Social Psychology*, 18, 433–463.
- Deuter, C. E., Best, D., Kuehl, L. K., Neumann, R., & Schächinger, H. (2014). Effects of approach-avoidance related motor behaviour on the startle response during emotional picture processing. *Biological Psychology*, 103, 292–296. doi: 10.1016/j.biopsycho.2014.09.013
- Eder, A. B., & Rothermund, K. (2008). When do motor behaviors (mis)match affective stimuli? An evaluative coding view of approach and avoidance reactions. *Journal of Experimental Psychology: General*, 137, 262–281. doi: 10.1037/0096-3445.137.2.262
- Fenske, M. J., Raymond, J. E., Kessler, K., Westoby, N., & Tipper, S. P. (2005). Attentional inhibition has social-emotional consequences for unfamiliar faces. *Psychological Science*, 16, 753–758. doi: 10.1111/j.1467-9280.2005.01609.x
- Fiske, S. T. (1992). Thinking is for doing: Portraits of social cognition from Daguerreotype to laserphoto. *Journal of Personality and Social Psychology*, 63, 877–889. doi: 10.1037/0022-3514.63.6.877
- Fiske, S. T., Cuddy, A. J. C., & Glick, P. (2007). Universal dimensions of social cognition: Warmth and competence. *Trends in Cognitive Sciences*, 11, 77–83. doi: 10.1016/j.tics.2006.11.005
- Forrest, J. A., & Feldman, R. S. (2000). Detecting deception and judge's involvement: Lower task involvement leads to better lie detection. *Personality and Social Psychology Bulletin*, 26, 118–125. doi: 10.1177/0146167200261011
- Friedman, R. S., & Förster, J. (2008). Activation and measurement of motivational states. In A. J. Elliot (Ed.) *Handbook of approach and avoidance motivation* (pp. 235–248). New York: Psychology Press.
- Fritz, M. S., & MacKinnon, D. P. (2007). Required sample size to detect the mediated effect. *Psychological Science*, 18, 233–239. doi: 10.1111/j.1467-9280.2007.01882.x
- Greifeneder, R., Bless, H., & Pham, M. T. (2011). When do people rely on affective and cognitive feelings in judgment? A review. *Personality and Social Psychology Review*, 15, 107–141. doi: 10.1177/1088868310367640
- Hartwig, M., & Bond, C. F. (2011). Why do lie-catchers fail? A lens model meta-analysis of human lie judgments. *Psychological Bulletin*, 137, 643–659. doi: 10.1037/a0023589
- Hastie, R., & Park, B. (1986). The relationship between memory and judgment depends on whether the judgment task is memory-based or on-line. *Psychological Review*, 93, 258–268. doi: 10.1037/0033-295X.93.3.258
- Hayes, A. F. (2018). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach* (2 ed.). New York: Guilford Press.
- Jackob, N., Roessing, T., & Petersen, T. (2016). Effects of verbal and non-verbal elements in communication. In A. Rocci & L. de Saussure (Eds.), *Verbal communication* (pp. 39–53). Berlin: De Gruyter.

- Krieglmeyer, R., Deutsch, R., De Houwer, J., & De Raedt, R. (2010). Being moved: Valence activates approach-avoidance behavior independently of evaluation and approach-avoidance intentions. *Psychological Science*, 21, 607–613. doi: 10.1177/0956797610365131
- Landström, S., Granhag, P. A., & Hartwig, M. (2005). Witnesses appearing live versus on video: Effects on observers' perception, veracity assessments and memory. *Applied Cognitive Psychology*, 19, 913–933. doi: 10.1002/acp.1131
- Ledoux, J. E. (1989). Cognitive-emotional interactions in the brain. *Cognition & Emotion*, 3, 267–289. doi: 10.1080/02699938908412709
- Levine, T. R. (2014). Truth-Default Theory (TDT): A theory of human deception and deception detection. *Journal of Language and Social Psychology*, 33, 378–392. doi: 10.1177/0261927X14535916
- Levine, T. R., Kim, R. K., & Blair, J. P. (2010). (In)accuracy at detecting true and false confessions and denials: An initial test of a projected motive model of veracity judgments. *Human Communication Research*, 36, 82–102. doi: 10.1111/j.1468-2958.2009.01369.x
- Levine, T. R., Serota, K. B., Shulman, H., Clare, D. D., Park, H. S., Shaw, A. S., . . . Lee, J. H. (2011). Sender demeanor: Individual differences in sender believability have a powerful impact on deception detection judgments. *Human Communication Research*, 37, 377–403. doi: 10.1111/j.1468-2958.2011.01407.x
- Masip, J., Garrido, E., & Herrero, C. (2009). Heuristic versus systematic processing of information in detecting deception: Questioning the truth bias. *Psychological Reports*, 105, 11–36. doi: 10.2466/pr0.105.1.11-36
- O'Sullivan, M. (2003). The fundamental attribution error in detecting deception: The boy-who-cried-wolf effect. *Personality and Social Psychology Bulletin*, 29, 1316–1327. doi: 10.1177/0146167203254610
- Olson, J. M., & Janes, L. M. (2002). Vigilance for differences: Heightened impact of differences on surprise. *Personality and Social Psychology Bulletin*, 28, 1084–1093. doi: 10.1177/01461672022811007
- Phaf, R. H., Mohr, S. E., Rotteveel, M., & Wicherts, J. M. (2014). Approach, avoidance, and affect: A meta-analysis of approach-avoidance tendencies in manual reaction time tasks. *Frontiers in Psychology*, 5 (378). doi: 10.3389/fpsyg.2014.00378
- R Core Team (2017). *R: A language and environment for statistical computing*. R Foundation for Statistical Computing, Vienna, Austria. 2016.
- Reinhard, M.-A. (2010). Need for cognition and the process of lie detection. *Journal of Experimental Social Psychology*, 46, 961–971. doi: 10.1016/j.jesp.2010.06.002
- Reinhard, M.-A., & Sporer, S. L. (2008). Verbal and nonverbal behaviour as a basis for credibility attribution: The impact of task involvement and cognitive capacity. *Journal of Experimental Social Psychology*, 44, 477–488. doi: 10.1016/j.jesp.2007.07.012
- Reinhard, M.-A., & Sporer, S. L. (2010). Content versus source cue information as a basis for credibility judgments: The impact of task involvement. *Social Psychology*, 41, 93–104. doi:10.1027/1864-9335/a000014
- Reinhard, M.-A., Sporer, S. L., Scharmach, M., & Marksteiner, T. (2011). Listening, not watching: Situational familiarity and the ability to detect deception. *Journal of Personality and Social Psychology*, 101, 467–484. doi: 10.1037/a0023726
- Rotteveel, M., Gierholz, A., Koch, G., van Aalst, C., Pinto, Y., Matzke, D., ... Wagenmakers, E.-J. (2015). On the automatic link between affect and tendencies to approach and avoid: Chen and Bargh (1999) revisited. *Frontiers in Psychology*, 6 (335). doi: 10.3389/fpsyg.2015.00335
- Rouder, J. N. & Morey, R. D. (2011). A Bayes Factor Meta-Analysis of Bem's ESP Claim. *Psychonomic Bulletin & Review*, 18, 682–689. doi: 10.3758/s13423-011-0088-7.
- Rule, N. O., Slepian, M. L., & Ambady, N. (2012). A memory advantage for untrustworthy faces. *Cognition*, 125, 207–218. doi: 10.1016/j.cognition.2012.06.017
- Scholer, A. A., & Higgins, E. T. (2008). People as resources: Exploring the functionality of warm and cold. *European Journal of Social Psychology*, 38, 1111–1120. doi: 10.1002/ejsp.509
- Schwarz, N. (2012). Feelings-as-information theory. In P. A. M. Van Lange, E. T. Higgins (Eds.), *Handbook of theories of social psychology* (pp. 289–308). Thousand Oaks, CA: Sage.
- Seibt, B., Neumann, R., Nussinson, R., & Strack, F. (2008). Movement direction or change in distance? Self- and object-related approach-avoidance motions. *Journal of Experimental Social Psychology*, 44, 713–720. doi: 10.1016/j.jesp.2007.04.013
- Slepian, M. L., Young, S. G., & Harmon-Jones, E. (2017). An approach-avoidance motivational model of trustworthiness judgments. *Motivation Science*, 3, 91–97. doi: 10.1037/mot0000046
- Slepian, M. L., Young, S. G., Rule, N. O., Weisbuch, M., & Ambady, N. (2012). Embodied impression formation: Social judgments and motor cues to approach and avoidance. *Social Cognition*, 30, 232–240. doi: 10.1521/soco.2012.30.2.232
- Steiger, J. H. (2004). Beyond the F test: Effect size confidence intervals and tests of close fit in the analysis of variance and contrast analysis. *Psychological Methods*, 9, 164–182. doi: 10.1037/1082-989X.9.2.164
- Stiff, J. B., & Mongeau, P. A. (2016). *Persuasive communication* (3rd ed.). New York: Guilford.
- Street, C. N. (2015). ALIED: Humans as adaptive lie detectors. *Journal of Applied Research in Memory and Cognition*, 4, 335–343. doi: 10.1016/j.jarmac.2015.06.002
- Thibodeau, R. (2011). Approach and withdrawal actions modulate the startle reflex independent of affective valence and muscular effort. *Psychophysiology*, 48, 1011–1014. doi: 10.1111/j.1469-8986.2010.01159.x
- Todorov, A., Baron, S. G., & Oosterhof, N. N. (2008). Evaluating face trustworthiness: A model based approach. *Social Cognitive and Affective Neuroscience*, 3, 119–127. doi: 10.1093/scan/nsn009

- Todorov, A., & Engell, A. D. (2008). The role of the amygdala in implicit evaluation of emotionally neutral faces. *Social Cognitive and Affective Neuroscience*, 3, 303-312. doi: 10.1093/scan/nsn033
- Ulatowska, J. (2014). Different questions—different accuracy? The accuracy of various indirect question types in deception detection. *Psychiatry, Psychology and Law*, 21(2), 231-240.
- Van Dessel, P., De Houwer, J., & Gast, A. (2016). Approach–avoidance training effects are moderated by awareness of stimulus–action contingencies. *Personality and Social Psychology Bulletin*, 42, 81–93. doi: 10.1177/0146167215615335
- Vrij, A. (2008). *Detecting lies and deceit: Pitfalls and opportunities* (2nd ed.). Chichester, UK: Wiley.
- Vrij, A., Edward, K., & Bull, R. (2001). Police officers' ability to detect deceit: The benefit of indirect deception detection measures. *Legal and Criminological Psychology*, 6, 185–96.
- Wagenmakers, E.-J., Beek, T., Dijkhoff, L., Gronau, Q. F., Acosta, A., Adams, R. B., ... Zwaan, R. A. (2016). Registered replication report: Strack, Martin, & Stepper (1988). *Perspectives on Psychological Science*, 11, 917–928. doi: 10.1177/1745691616674458
- Way, B. M., & Masters, R. D. (1996). Emotion and cognition in political information-processing. *Journal of Communication*, 46, 48–65. doi: 10.1111/j.1460-2466.1996.tb01488.x