How Does the Content of a Lie Affect How Lies and Liars Are Perceived?

Emmett Louis Meyer (s2812908)

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Faculty of Behavioural, Management, and Social Sciences - University of Twente

Psychology of Conflict, Risk, and Safety

1st Supervisor: Dr Steven J. Watson

2nd Supervisor: Dr Lynn Weiher

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During the preparation of this work, the author used no artificial intelligence tools.

Abstract

The view that humans are ultimately poor in detecting deception despite the existence of some objective cues was predominant in the past decades. However, research highlighting the context-dependency of widely accepted objective cues and the involvement of processes outside conscious awareness in deception detection underlines a need to shift back to basic assumptions about objective and subjective cues. The present study aimed to explore the role of a narrative's emotional valence. In a laboratory study, video stimuli in which speakers talked about topics with varying emotional valence were presented to 31 university students in a 3 (emotional valence) x 2 (veracity) full-factorial within-subjects design. For each video, perceived accuracy, perceived sender impression, and perceived emotional valence were measured with single items to investigate the direct effects of the independent variables on the participants' perception and shed light on processes underlying these perceptions. A linear mixed model revealed a significant interaction of emotional valence and veracity on perceived emotional valence. Ratings of negative truthful stimuli were more extreme than of negative deceptive stimuli, but such a difference was not observed for positive stimuli. However, compared to neutral stimuli, positive truthful ones were perceived as more positive than deceptive ones. While no direct effects of the independent variables were found on perceived accuracy and perceived sender impression, positive associations between all the dependent variables were observed. The findings provide support for the view that deception detection performance is generally rather poor and context-dependent and that liars could hypothetically present themselves and their stories in a positive light to appear more credible. Future research can build up on these findings by focusing on more specific contexts and investigating the extent to which positive self-presentations are used by liars.

How Does the Content of a Lie Affect How Lies and Liars Are Perceived?

Lying is an undeniable part of human social interaction. While motives, goals, and characteristics that underlie deceptive communication are as diverse as humans themselves, the view that people tend to lie daily across age groups and cultures remains constant (DePaulo & Kashy, 1998; Verigin et al., 2019). Consequently, knowledge about characteristics and processes of deceptive communication is well appreciated in areas ranging from personal relationships, over economics, to legal and forensic contexts. The interest in this topic is reflected in over 90 years of psychological investigation that yielded considerable insights and does not seem to stop (Lasswell, 1933; Volz et al., 2023). Past research in this domain has usually focused on the two most obvious elements of deceptive communication: Senders were instructed to tell lies and truths while being video recorded and receivers were then asked to judge the veracity of these narratives.

Analysing video recordings of the sender serves to identify objective cues to deception. In other words, such investigations are supposed to reveal what objectively differentiates liars from truthtellers to enable more valid veracity judgments. Some research lines have taken a straightforward approach by focusing on observable behaviours. Many of them are included in the extensive meta-analysis by DePaulo et al. (2003), which combined the results of over 1300 estimates of verbal and nonverbal correlates of deception and found that there are only a few reliable objective cues to deception. One of these cues is that lies tend to contain "more negative statements and complaints" (p. 94) compared to truths. The authors explain this finding with potential feelings of guilt that seep through when lying or fear of getting caught.

However, past studies along with their conclusions have recently been challenged and the literature offers alternative explanations for deceptive behaviour that have received little attention. On a general level, Luke (2019) critically highlights systematic problems like

selective reporting and underpowered studies, thus questioning the validity of widely accepted objective cues. Arguably, the very notion of rigid objective cues may be problematic because they may actually be highly context-dependent and thereby prone to interferences of the experimental setup. For example, feelings of guilt may result from a simulated malicious intention or transgression (DePaulo et al., 2003). In contrast, prosocial lies are by definition told with good intentions and this may be reflected in a more positive emotional valence (Lupoli et al., 2017). An even clearer example of experimental interference is the study by Knapp et al. (1974), which is included in DePaulo et al.'s (2003) meta-analysis. Here, the liars had to argue against increasing educational benefits for veterans while truthtellers had to argue in favour of this position. It is therefore hardly surprising that liars used considerably more negative statements than truthtellers in this particular study. A further alternative perspective on the use of emotional valence in deceptive communication can be derived from findings about self-presentation. Feldmann et al. (2002) argue that people are prone to lying in situations that require favourable self-presentation, and research on job interviews and social media consistently shows that self-presentations tend to be more positive and sometimes indeed deceptive (Paulhus et al., 2013; Bareket-Bojmel et al., 2015; Ellisson et al., 2006; Toma et al., 2008). Taken together, these considerations challenge DePaulo et al.'s (2003) view that negative statements are an objective cue to deception.

Research lines addressing the receiver of lies face different, but equally serious challenges. Findings have long been centred around the predominant view that humans are ultimately poor at detecting deception. This view is indeed supported by the widely cited meta-analysis by Bond and DePaulo (2006), in which they conclude that both trained and untrained individuals only achieve an average of 54% correct lie-truth judgments. The fact that this performance is only minimally better than what would be expected by mere chance stimulated discussions about the reasons. For example, it has been suggested that the use of wrong cues

or the mere absence of enough cues for a valid judgment plays a role (Bond & DePaulo, 2006).

Yet, more recent debates and new research lines keep yielding insights that paint a more complex picture. Reinhard & Sporer (2010) were among the first to address the processes underlying deception detection by applying classical dual processing models to the matter. Their findings show that greater task involvement broadens the range of cues that people base their veracity judgments on, which implies that processes outside conscious awareness influence these judgments. This notion is unequivocally underlined by a series of experiments by Reinhard et al. (2013), which revealed that deception detection performance can be significantly increased by using periods of unconscious deliberation. That is, when people do not consciously focus on detecting deception, their performance can be improved by up to 20 percentage points. Consequently, Hartwig and Bond (2011) and Reinhard et al. (2013) consistently argue that people appear to make use of the right cues, but that limited conscious processing capacities may prevent the integration of multiple complex cues of which some cannot be brought into conscious awareness. This aligns with Vrij's (2001) finding that asking for veracity judgments in more indirect ways can improve detection accuracy. In summary, these findings imply that humans are theoretically fit to make more valid veracity judgments by using and integrating cues outside conscious awareness.

Problems and critique associated with research on both sides of the deceptive communication pipe call for new approaches and a shift back to basic assumptions about the perception of lies. The previous discussion about the unclear role of emotional valence in the facets of deception and its detection underlines the need to investigate if the full range of emotional valence serves as a subjective or even objective cue to deception. The findings suggesting that people may strategically manipulate the emotional valence to present themselves more positively imply that a narrative's emotional valence could generally serve as an objective cue to

deception. Although people do not report explicitly that emotional valence plays a role in their veracity judgments, it may serve as a cue that is processed and integrated outside conscious awareness, as discussed above (Global Deception Research Team, 2006; Reinhard et al., 2013). Therefore, the present study aims to answer the following research question: "*Does the receiver of a narrative perceive the narrative and its sender differently depending upon whether it is a lie or the truth, and does the emotional valence of the narrative have any relevance for these perceptions?".* The exploration of the influence of message characteristics aligns with a recent call by Volz et al. (2023) to disentangle person and message effects in studies about veracity judgments. In their article, they critically highlight that past research has usually regarded the sender and the message as a single entity, thereby neglecting that the message itself may influence veracity judgments. To illustrate, receivers may get suspicious if narratives are overly emotional or, on the contrary, not expect that negative accounts are made worse than they are. Furthermore, attempts of the sender to manipulate valence as part of their deception strategy may be reflected in the receiver's perception. For example, liars may tend to present more positive narratives to appear more likeable and trustworthy. However, many other findings are imaginable, and therefore this study addresses the role of emotional valence in an exploratory way.

In answering the research question, this study will extend past research by incorporating some unique features. First, it will extend binary measures of perceived veracity by not only considering intentional deception but also (partly) inaccurate accounts resulting from gaps in memory. Such a measure is considered more realistic across relevant contexts. For example, in investigative interviews, the usual goal is assessing to what extent a statement corresponds to reality rather than making a black-and-white decision about its veracity (Oleszkiewicz et al., 2023). Second, this study not only looks at the role of emotional valence and veracity on perceived accuracy but sheds further light on the processes that underlie this judgment, i.e. successful or unsuccessful attempts of the sender to present themselves in a more

positive light. Third, as discussed above, this study will rely on video stimuli that were recorded with less interference from the experimental setup. Combined with extending previous investigations, answering the research question could lay the groundwork for further fruitful and more specific psychological investigations about the role of emotional valence in deceptive narratives across different contexts.

Method

Design

This study involved participants watching video stimuli in which speakers describe the content of videos with varying emotional valence that they had previously seen. A 3 (emotional valence) x 2 (veracity) full-factorial within-subjects design was employed to measure the effects on three dependent variables, namely perceived accuracy, perceived emotional valence, and perceived sender impression. Participants completed each condition twice to get adequate observations for each condition and to increase statistical power. The speakers in the videos were varied to enable controlling for effects emerging from the speaker and to cover a broad range of approaches to deception.

Participants

Ethical approval was granted for this study by the BMS ethics committee at the University of Twente (request number 240149). A convenience sample was collected using the test subject pool of the University of Twente (SONA), an online form that was spread on social media, and flyers that were distributed in university buildings. The sample size was determined by feasibility and the availability of laboratory capacities. People could only participate if they had not already taken part in the study in which the stimulus material was created to not jeopardise proper manipulation. Students who must collect participation hours as part of their curriculum were given one SONA credit for their participation.

A total of 31 university students participated. Most of them identified as female (n = 26), and the rest as male. Their ages ranged from 18 to 25 years with a mean of 20.94 years (SD = 1.93 years). The majority's nationality was German (n = 20), followed by Dutch participants (n = 6), and other nationalities (n = 5). In terms of education, the vast majority had completed high school education (n = 30), and the remaining participant had completed professional training.

Materials and Measures

Video Stimuli

The video stimuli were taken from a master's thesis study that was conducted at the University of Twente (Janus, 2023). Participants in this study watched videos about topics with varying emotional valence, i.e. negative, neutral, and positive ones. For example, a positive video described how a woman successfully rescued an injured dolphin. Further examples of the videos' topics can be found in Table 1. Afterwards, the participants were asked to summarise the content either truthfully or deceptively in a webcam recording. Importantly, in contrast to earlier studies, the individuals in the recordings were given no instructions about how to speak so that a range of different approaches to deception was covered and interference from such instructions was avoided. This procedure yielded a total of 179 recordings. The entirety of videos was pre-sorted by excluding inadequate or flawed material, i.e. videos that were inaudible, incomplete, and shorter than 20 or longer than 60 seconds. Some recordings were inadequate for other obvious reasons. For instance, there was one individual who always started the recording by saying if they are lying or telling the truth.

Of the 124 remaining videos, five videos per experimental condition were randomly chosen to ensure diversity in the speakers so that unwanted effects of the speaker's characteristics can be controlled for and to further increase diversity in approaches to deception. Eventually, the set of stimuli consisted of 30 videos with lengths ranging from 26 to 60 seconds, a

mean length of 44.6 seconds (*SD* = 10.38 seconds), and 21 different speakers. Seventeen videos contained a male speaker, and the other 13 a female speaker.

Table 1

Examples of the Content of the Original Video Stimuli for Each Level of Emotional Valence

Emotional Valence	Video Content
Negative	Interviews with victims of torture in US prisons
Neutral	Interviews with employees of a printery who talk about the company's history
Positive	Interviews with nurses in a hospital where puppies visit patients to increase their well-being

Digital Questionnaire

The questionnaire was created using Qualtrics and JavaScript. Each dependent variable was operationalised with one item that appeared face valid, respectively. Using only one item per dependent variable was further considered sensible because the aim of this study is to capture global and intuitive impressions rather than elaborate ones. Videos and the corresponding items were presented in a random order. The layout and content of the questionnaire can be found in Appendix A.

Perceived accuracy was measured with the item "How accurately do you think the person is describing what they saw?", which included six response options. Asking for accuracy ratings instead of direct veracity judgments was considered useful for two reasons. First, the two concepts are closely related, but ratings of accuracy are broader, more nuanced, and more natural. To illustrate, people can either lie on purpose or try to be honest while actually being inaccurate simply due to a lack of memory. Whatever the reason is, the primary interest of in

most contexts lies in judging nuances of accuracy rather than the two extremes of veracity in most contexts. This is especially true for investigative interviews (Oleszkiewicz et al., 2023). Second, the findings of Vrij (2001) highlight the advantage of using indirect questions to measure judgments of deception because this avoids creating decision goals that interfere with intuitive impressions. The six answer options ranged from "Extremely inaccurate" to "Extremely accurate" and were coded from 0 (extremely inaccurate) to 5 (extremely accurate) for data analysis. These six response options render the item a forced choice item to prevent participants from avoiding a decision because they are uncertain.

Perceived sender impression was measured with "Which description best fits your impression of the person who was talking?". This measure sheds light on the processes that underlie judgments of accuracy by considering the perception of potential self-presentation strategies of the sender. Furthermore, it enables evaluating the association between ratings of the sender and perceived accuracy on a more general level. The five response options ranged from "Very positive" to "Very negative", including a neutral option. The options were coded from 0 (very negative) to 4 (very positive) for data analysis.

Lastly, perceived emotional valence was measured using the item "Which description best fits your impression of the topic that the person talked about?". This item serves as a manipulation check. Furthermore, like the previous item, this item is also intended to give insight into the effect of deception strategies. For example, a liar may try to tell a more positive story to appear more likeable and, in turn, more trustworthy. The five response options also ranged from positive to negative with a neutral option and were coded in the same way as the options for the perceived sender impression item.[1]

[1] In the second half of data collection, one participant reported having misunderstood the item measuring perceived emotional valence. They thought that the item referred to their personal interest in the topic of the video rather than its emotional valence. All ensuing participants were asked about their understanding of the item after the study and did not confirm this misunderstanding. However, no statement can be made about the participants who took part before this incident.

Procedure

Because basic perceptual processes were of interest, the study took place in a standardised laboratory environment at the University of Twente to control for distorting environmental factors and the possibility of robot responses in online questionnaires (Ciccarelli & White, 2020).

The study was introduced to the participants as a study about "Impression Formation in Interpersonal Communication" to prevent creating decision goals and thereby influence the participants' thinking mode. This practice is in line with implications and explicit recommendations of Vrij (2001) and Reinhard et al. (2013). Participants were provided with headphones and seated in front of a computer screen in a small, enclosed room. After reading the study information and clarifying questions, they gave informed consent and were left alone to finish the questionnaire. It started with demographic questions (age, gender identity, nationality, current occupation, and educational level). After that, the presentation of stimuli started and progressed in a random order to control for ordering effects. The participants were shown one random video stimulus of a random condition at a time and asked if they know the person talking personally. If they indicated yes, another random video from the same condition was shown to prevent unwanted effects of personal acquaintance. If they indicated no, they were forwarded to the items measuring the dependent variables, which were presented in a random order as well. This pattern was repeated until two trials for each condition were completed. It was ensured that the same video was not presented twice. Afterwards, they were debriefed and thanked for their participation. The whole procedure took no longer than 30 minutes.

Data Analysis

The data was analysed using R version 4.3.1 with the packages "tidyverse", "dplyr", "modelr", "lme4", "lmerTest", and "emmeans". The code that was used for the analysis can be found in Appendix C.

Three linear mixed models with restricted maximum likelihood estimation were employed to test the effects of valence (positive/negative/neutral) and veracity (truth/lie) on the three dependent variables. The type I error rate was set to .05 and degrees of freedom were estimated using Satterthwaite's method. Random effects were included for the effect of the participants to control for the repeated measurements and for the effect of the speakers in the videos. This was considered sensible because phenomena like the halo effect show that systematic patterns in judgments may emerge simply as the result of the person who is talking (Nisbett & Wilson, 1977). Similarly, it is likely that the participants themselves are a source of variation in judgments (Moore, 2014).

Results

Descriptive Statistics

Correlations between the dependent variables along with their mean ratings are presented in Table 2. Ratings of perceived accuracy ranged from "extremely inaccurate" to "extremely accurate". The distribution of responses was negatively skewed. Perceived sender impression was rated from "extremely negative" to "extremely positive", but the most extreme answer options were chosen in only 23 out of 372 total trials. The distribution resembled a normal distribution. Lastly, ratings of perceived valence ranged from "extremely negative" to "extremely positive" and appeared to approach a flatter distribution. Figures C1-C3 in Appendix C graphically show the distributions of responses for each dependent variable. All combinations of the dependent variables were significantly correlated with each other ($p < .001$). Perceived accuracy and perceived sender impression were moderately positively correlated. The other dependent variables were weakly positively correlated.

Table 2

Correlation Coefficients of the Dependent Variables

	M	*SD*	Perceived Accuracy	Perceived Sender Impression	Perceived Emotional Valence
Perceived Accuracy	3.27	1.10	-	-	-
Perceived Sender Impression	2.28	0.82	.42	-	-
Perceived Emotional Valence	2.02	1.32	.17	.27	-

Note. For all correlations, $p < .001$ with $df = 370$.

Inferential Statistics

Assumptions of Linear Models

The assumptions of linear models were checked graphically to avoid problems associated with parametrical tests (Zuur et al., 2009). Histograms of the residuals for each of the three models show that the assumption of normality of residuals is met. After introducing the random effects to the models, the variances of the residuals become independent of the speaker and the judge. Figures C4-C9 in Appendix C were used for the assessment.

Hypothesis Tests

Estimated marginal means with their standard errors and *F*-test outcomes are presented in Table 3. For each dependent variable, a linear mixed model tested the effects of veracity and emotional valence and included random effects for participants and speakers.

For the Perceived Accuracy model, the between-participant standard deviation was 0.36, the between-speaker standard deviation was 0.50, and the residual standard deviation

was 0.93. All main effects were nonsignificant, suggesting that categories of neither emotional valence nor veracity can account for variation in perceived accuracy. The interaction effect was nonsignificant too.

For the Perceived Sender Impression model, the between-judge standard deviation was 0.23 and the between-speaker standard deviation was 0.35, while the residual standard deviation was 0.70. All main effects were nonsignificant, suggesting that perceived sender impression neither differs between true and false narratives, nor between negative, positive, and neutral ones. The interaction effect was nonsignificant too.

For the Perceived Emotional Valence model, the between-judge standard deviation was 0.18 and the between-speaker standard deviation was 0.56, while the residual standard deviation was 0.76. The main effect of emotional valence was statistically significant, which suggests that ratings of perceived emotional valence differ between negative, positive, and neutral stimuli. A post hoc comparison of estimated marginal means with Sidak correction showed that neutral videos were rated significantly more positive than negative videos ($p < .001$), and positive videos were rated significantly more positive than both negative and neutral videos ($p < .001$). This suggests that the participants tended to perceive the emotional valence of the videos as intended.

While the main effect of veracity was nonsignificant, the interaction effect of veracity and emotional valence was statistically significant. A post hoc comparison of estimated marginal means with Sidak correction revealed two major differences. First, perceived emotional valence differed significantly between the levels of veracity for negative videos ($p < .001$) only. Specifically, truthful negative videos were rated as more negative than deceptive negative videos. For neutral ($p = .973$) and positive ($p = .572$) videos, the differences between the levels of veracity were nonsignificant. Second, the difference between neutral and positive videos was nonsignificant for deceptive videos ($p = .102$) but significant for truthful videos (p

< .001). All other differences in perceived emotional valence between levels of emotional valence were significant across the levels of veracity. Figure 1 graphically visualises the interaction effect.

Table 3

Estimated Marginal Means per Experimental Condition and Statistics of the Hypothesis Tests for all Dependent Variables

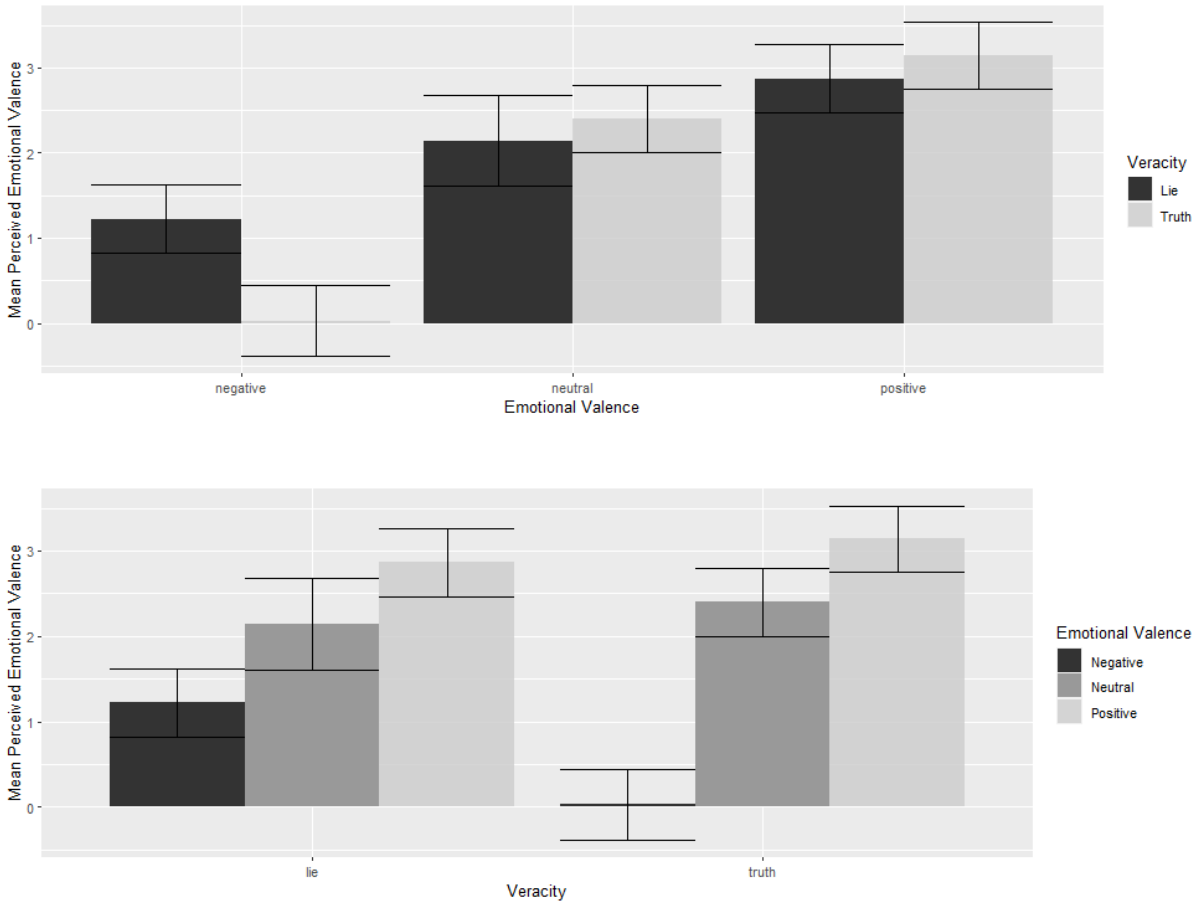
Independent Variable	**Dependent Variables**					
Veracity	PAC		PSI		PEV	
	M	*SE*	*M*	*SE*	*M*	*SE*
Truth	3.35	0.16	2.28	0.12	1.86	0.16
Lie	3.23	0.15	2.31	0.11	2.08	0.15
Hypothesis Test	*F* (1, 63) = .70, *p* = .406		*F* (1, 68) = .11, *p* = .740		*F* (1, 47) = 2.54, *p* = .118	
Emotional Valence	PAC		PSI		PEV	
	M	*SE*	*M*	*SE*	*M*	*SE*
Positive	3.32	0.19	2.47	0.14	3.00	0.18
Negative	3.38	0.19	2.22	0.13	0.63	0.18
Neutral	3.17	0.18	2.19	0.13	2.27	0.17
Hypothesis Test	*F* (2, 61) = .48, *p* = .622		*F* (2, 61) = 2.16, *p* = .124		*F* (2, 66) = 92.84, *p* < .001	
Interaction Term	PAC		PSI		PEV	
	M	*SE*	*M*	*SE*	*M*	*SE*
Truth/Positive	3.44	0.21	2.56	0.16	3.14	0.20
Truth/Negative	3.43	0.23	2.07	0.16	0.03	0.21
Truth/Neutral	3.18	0.22	2.20	0.16	2.40	0.20
Lie/Positive	3.19	0.22	2.38	0.16	2.87	0.20

Lie/Negative	3.33	0.22	2.37	0.16	1.22	0.21
Lie/Neutral	3.17	0.26	2.19	0.19	2.14	0.27
Hypothesis Test	F (2, 77) = .24, p = .789		F (2, 78) = 2.11, p = .129		F (2, 74) = 15.10, p < .001	

Note. PAC=Perceived Accuracy, PSI=Perceived Sender Impression, PEV=Perceived Emotional Valence

Figure 1

Estimated Marginal Means of Perceived Emotional Valence for the Different Levels of Emotional Valence and Veracity with 95% Confidence Intervals



Discussion

Considering challenges of past research on deception detection, the purpose of the present study was to explore whether and how the veracity and emotional valence of a narrative's content influence its perception. The results indicate that neither veracity nor emotional

valence and their interaction influence ratings of perceived accuracy and the impression of the sender. While emotional valence generally affects ratings of perceived valence, a significant interaction between emotional valence and veracity was found too. More specifically, negative truthful videos were rated as more negative than negative deceptive videos. Furthermore, differences in perceived emotional valence between neutral and positive narratives were only significant for truthful narratives, but not for deceptive ones. Correlations between the dependent variables suggest that higher ratings of accuracy are associated with more positive evaluations of the speaker and that positive narratives are associated with both more positive evaluations of the speaker and higher ratings of accuracy.

Perceived Accuracy

When rating the accuracy of a particular video, participants could generally not differentiate between truthful and deceptive narratives. This aligns with previous findings that deception detection is difficult, especially without periods of unconscious deliberation that increase processing capacity (Bond & DePaulo, 2006; Reinhard et al., 2013). Interestingly, this prominent finding could be replicated although perceived accuracy instead of a binary veracity judgment was measured. Participants also appeared to exhibit a truth bias, i.e. they generally tended to assume high levels of accuracy. This bias is consistently observable in binary ratings of veracity too (Bond & DePaulo, 2006). Furthermore, the moderate positive association between evaluations of the sender and perceived accuracy are in line with the trust model of Mayer et al. (1995), which predicts trust from the three attributes ability, benevolence, and integrity. According to this model, people who are perceived as highly competent, benevolent, and integer tend to be judged as more trustworthy. This highlights that ratings of perceived accuracy may reflect ratings of trust to at least some extent. Taken together, these findings demonstrate that measurements of perceived accuracy share some important features with

binary ratings of veracity. Given that the term “accuracy” covers a wider and more natural range of deceptive behaviour, future studies are encouraged to adopt this measure.

Perceived accuracy was not rated differently depending on the level of emotional valence either. However, as discussed before, the success and processes of deception and its detection are always intertwined with the context. Since the aim of this study was to cover a broad range of approaches to deception by giving no instructions to the speakers, it is conceivable that a narrative’s emotional valence is more diagnostic of deception in more specific contexts. For example, a person who talks very positively about themselves in a job interview may be perceived as less honest than a person who talks rather negatively about themselves. Future research could address this idea by manipulating the emotional valence of narratives in contexts that are likely to render the emotional valence more diagnostic.

Perceived Sender Impression

The participants did not perceive the speakers differently depending on whether they were lying or telling the truth, or depending on the emotional valence of the topic they were talking about. Consequently, it can be assumed that the speakers in the videos did not strategically try to appear more likeable or that their attempt to do so failed. It must be noted, however, that the more extreme rating options of perceived sender impression were chosen in few trials, which may indicate a social desirability effect (Ciccarelli & White, 2020). However, positive associations with both ratings of perceived emotional valence and perceived accuracy nevertheless suggest that strategic use of emotional valence in deceptive communication can theoretically lead to greater ratings of accuracy. Although speakers did not appear to display such behaviours in the present study, it is conceivable in different contexts. For instance, a suspect in an interview may try to appear likeable to the interviewer to achieve higher perceptions of trustworthiness. Though, the direction of causality and the nature of the underlying

mechanisms remains unclear. Therefore, future research could experimentally investigate how ratings of trustworthiness relate to the fabrication of positive impressions.

Perceived Emotional Valence

Participants perceived truthful negative videos as more negative than deceptive negative videos. This observation challenges DePaulo et al.'s (2003) notion that lies are more negative due to feelings of guilt or fear of getting caught. In contrast, these findings align with the notion that liars may strategically try to present a more positive story to appear more positive and thereby more trustworthy. The small positive association between perceived emotional valence on the one hand, and perceived accuracy and perceived sender impression on the other hand shows that such an approach is theoretically reasonable, but the direction of causality and the exact mechanisms remain unclear. Moreover, this finding could also result from DePaulo et al.'s (2003) observation that deceptive speakers are simply less emotionally involved compared to truthful speakers because they must fabricate emotional experiences instead of actually experiencing them. The finding that positive videos are rated as more positive relative to neutral videos only when they are truthful further supports this idea, but a significant difference in ratings of emotional valence between deceptive and truthful videos was not observed. Taken together, these findings imply a broader role of emotional valence in deceptive behaviour than previously presumed. This is not to say that DePaulo et al.'s (2003) explanations are wrong, but that there are contexts in which other explanations are in place. Therefore, future research is encouraged to look at the behaviour of liars more closely in more specific contexts. For example, mixed method approaches could investigate how liars and truthtellers in job interviews differ in terms of self-enhancing nonverbal and verbal behaviour and in attempts to create a more positive story.

Limitations of the Present Study

The most important limitation of this study comes with the inclusion of diverse approaches to deception. Speakers in past studies were often given specific instructions about how to lie for manipulation purposes, but the present study used materials in which such instructions were rare to increase internal validity. However, the rather uncontrolled way in which the videos were recorded makes it impossible to disentangle the respective individual contributions of the senders and the receivers to the observed effects. For example, it cannot be said with certainty whether the speakers did in fact not attempt to appear more likeable or if the absence of an effect has to do with an insensitivity in the participant's perception.

Another limitation pertains to the use of single-item measures for the dependent variables. It is often argued that multiple-item measures should be preferred to increase measurement validity and reliability and the previous notion of potential social desirability effects underlines this concern. However, the interest of this study were global impressions rather than complex latent constructs and such global impressions can be covered well with single-item measures (Allen et al., 2022). Furthermore, the use of multiple items could have led participants to think too much about their intuitive impressions, thereby rendering their responses different from their initial impressions.

Lastly, the absence of a concrete context in the present study and the low-stake nature of the lies make it difficult to generalise the findings. As noted before, different observations than in the present study may be made in future studies that simulate more specific contexts. However, since the purpose of the present study was to broadly explore alternatives to the predominant explanations of deceptive behaviour and its perception, a narrow context was considered inadequate.

Conclusion

The findings of this study extend the current understanding of deceptive behaviour and the perception of lies. It was found that emotional valence and veracity have no direct effect on perceived accuracy and perceived sender impression, but this may be different in other contexts. The finding that negative lies are judged as less negative compared to negative truths questions the view that lies contain more negative statements due to feelings of guilt or fear of getting caught. Although this study found no direct evidence for the use of positive self-presentation as a strategy for deception, positive associations between ratings of perceived accuracy, perceived emotional valence, and perceived sender impression show that such strategies may theoretically work. However, the causal relationships and the question of whether such strategies are actually used remain open for future research. Taken together, this study provided some evidence that the emotional valence of a narrative's content influences the perception of the narrative and its sender to some extent generally, but that this effect may be greater in different contexts.

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Appendix A: Questionnaire

Start of Block: Study Information

Study Information – Impression Formation in Interpersonal Communication

Thank you very much for your willingness to participate in this study, which is connected to my bachelor's thesis in psychology. This page gives you a thorough overview of this project and your rights as a participant. Please read it carefully and feel free to ask questions whenever they appear.

Purpose of the Study

This study explores how narratives with varying characteristics are perceived. Your participation will help to gain a better understanding of how certain characteristics of narratives influence perception and impression formation in interpersonal communication.

Inclusion/Exclusion Criteria

Please make sure that you did not participate in the study "(Dis)Entangling Lies and Emotion" because this could distort the results of this study.

Participation Procedure

You are going to watch a total of 12 short video clips in which individuals describe the content of a video that they have seen right before. After each video, you will answer some simple questions about your impressions. The procedure will take no longer than 30 minutes.

Risks and Benefits

This study was granted ethical approval by the BMS Ethics Committee (request number 240149), which affirms that the risks of participating in this study are minimal. The most likely risk is experiencing negative emotional reactions like distress or fear due to the content of the videos that are described. To further reduce this risk, please inform the researcher if you react strongly to descriptions of the following topics:

- Dogs

- Dolphins

- Torture

If you are a BMS student taking part in a programme where SONA credits are required, you will be granted one SONA credit for your participation in this study. Other participants will receive no benefits for their participation.

Withdrawal

Participation in this study is completely voluntary. You may decide to withdraw your participation at any point without having to give a reason or explanation. Doing so will not lead to any negative consequences for you – you will still be granted the SONA credit, if applicable.

Data Collection, Usage, and Confidentiality

Your participation in this study is anonymous, which means that the researcher only knows you by your participant number. Furthermore, all data that you contribute to this study will be treated with confidentiality and data security. The only personal data that will be collected are your age, gender, nationality, and educational background. Collecting these data is important to get a better understanding of the people who participated in this study, but they are unlikely

to be sufficient to identify you personally. If you are worried about this, you can choose to not disclose this information. Your (anonymous) data will be stored for at least 10 years in line with BMS faculty policy to ensure proper research conduct. Your anonymous data might also be shared with the research community in line with the principles of open science, however, we again remind you that it is very unlikely anyone will be able to identify you individually from the data we collect and share. The results of this study will at least be published on the UT theses repository and may also be published elsewhere, e.g. in a scientific journal or at an academic conference.

Contact Details

In case of further questions, requests, or complaints regarding this research project you may contact the researcher: Emmett L. Meyer, e.l.meyer@student.utwente.nl or the researcher's supervisor: Dr Steven J. Watson, s.j.watson@utwente.nl. If you have questions about your rights as a research participant, or wish to obtain information, ask questions, or discuss any concerns about this study with someone other than the researcher, please contact the Secretary of the Ethics Committee/domain Humanities & Social Sciences of the Faculty of Behavioural, Management, and Social Sciences at the University of Twente by ethicscommittee-hss@utwente.nl

Start of Block: Informed Consent

I have read and understood the study information or it has been read to me. I have been able to ask questions about the study and my questions have been answered to my satisfaction.

Yes

No

I consent voluntarily to be a participant in this study and understand that I can refuse to answer questions and I can withdraw from the study at any time, without having to give a reason.

Yes

No

I understand that taking part in the study involves watching several videoclips and answering a digital questionnaire about my perceptions.

Yes

No

I understand that taking part in the study involves the risk of experiencing distress or fear when reacting sensitively to the content.

Yes

No

I understand that information I provide will be used for the purpose of a Bachelor's thesis in which impression formation in interpersonal communication is explored. I understand that the results of this research will be published on the internet, but that my data will be anonymised.

Yes

No

I give permission for the data that I provide to be archived for at least 10 years to ensure the transparency and integrity of the research, and if the study is published in an academic outlet then the anonymised data will also be made available to the research community.

Yes

No

Start of Block: Demographics

Welcome to the study "Impression Formation in Interpersonal Communication". Before getting started, we would like to obtain some personal information to get a better understanding of the population that is studied.

How old are you?

What is your gender identity?

Male

Female

Non-binary / third gender

Other (please specify) _____

Prefer not to say

Which of the following options best describes your current occupation?

No current occupation

Trainee

Self-employed/entrepreneur

Employed part-time

Employed full-time

Student

Homemaker

Retired

Other (please specify) _____

Prefer not to say

What is the highest level of education that you have completed?

Middle School Education

High School Education

PhD

Bachelor's degree

Master's degree

No formal education

Other (please specify) _____

Prefer not to say

What is your nationality? If you have multiple: choose the one you identify most with

Dutch

German

Other (please specify) _____

Prefer not to say

Start of Block: Instruction

On the following pages, you will see several videos of people who describe a video that they have watched right before. After each video, you will be asked to answer the following questions:

-How accurately do you think the person is describing what they saw? (accurate - inaccurate)

-Which description best fits your impression of the person who was talking? (positive - negative)

-Which description best fits your impression of the topic that the person talked about? (positive – negative)

Please try to answer the questions as intuitively as possible - there is no right or wrong.

Keep in mind that you may always decide to withdraw your participation without having to give a reason.

Start of Block: Acquaintance

Do you know the person in the video personally?

No

Yes

Start of Block: Dependent Variables Measures

Which description best fits your impression of the topic that the person talked about?

Very negative

Somewhat negative

Neutral

Somewhat positive

Very positive

How accurately do you think the person is describing what they saw?

Extremely inaccurate

Mostly inaccurate

Somewhat inaccurate

Somewhat accurate

Mostly accurate

Extremely accurate

Which description best fits your impression of the person who was talking?

Very negative

Somewhat negative

Neutral

Somewhat positive

Very positive

Appendix B: R Code

```
library(tidyverse)
library(dplyr)

raw <- read.csv("rawdata.csv", stringsAsFactors = FALSE)

#Dropping unnecessary columns and coding answer options
cleaned <- raw [-c(1, 2), ] %>%
  mutate_at(vars(everything()), ~ifelse(. == "Extremely inaccurate", 0, .)) %>%
  mutate_at(vars(everything()), ~ifelse(. == "Mostly inaccurate", 1, .)) %>%
  mutate_at(vars(everything()), ~ifelse(. == "Somewhat inaccurate", 2, .)) %>%
  mutate_at(vars(everything()), ~ifelse(. == "Somewhat accurate", 3, .)) %>%
  mutate_at(vars(everything()), ~ifelse(. == "Mostly accurate", 4, .)) %>%
  mutate_at(vars(everything()), ~ifelse(. == "Extremely accurate", 5, .)) %>%
  mutate_at(vars(everything()), ~ifelse(. == "Very negative", 0, .)) %>%
  mutate_at(vars(everything()), ~ifelse(. == "Somewhat negative", 1, .)) %>%
  mutate_at(vars(everything()), ~ifelse(. == "Neutral", 2, .)) %>%
  mutate_at(vars(everything()), ~ifelse(. == "Somewhat positive", 3, .)) %>%
  mutate_at(vars(everything()), ~ifelse(. == "Very positive", 4, .))

#Demographics
cleaned$age_1_TEXT <- cleaned$age_1_TEXT %>% as.numeric()
cleaned$gender <- cleaned$gender %>% as.factor()
cleaned$nationality <- cleaned$nationality %>% as.factor()
cleaned$occupation <- cleaned$occupation %>% as.factor()
cleaned$education <- cleaned$education %>% as.factor()

summary(cleaned$age_1_TEXT)
sd(cleaned$age_1_TEXT)

summary(cleaned$gender)
summary(cleaned$nationality)
summary(cleaned$occupation)
summary(cleaned$education)
```

```
#Conversion of the video data so that they correspond to the speakers
cleaned$L_NEG_1[cleaned$L_NEG_1 == 1] <- 6
cleaned$L_NEG_1[cleaned$L_NEG_1 == 2] <- 7
cleaned$L_NEG_1[cleaned$L_NEG_1 == 3] <- 8
cleaned$L_NEG_1[cleaned$L_NEG_1 == 4] <- 9
cleaned$L_NEG_1[cleaned$L_NEG_1 == 5] <- 10

cleaned$L_NEG_2[cleaned$L_NEG_2 == 1] <- 6
cleaned$L_NEG_2[cleaned$L_NEG_2 == 2] <- 7
cleaned$L_NEG_2[cleaned$L_NEG_2 == 3] <- 8
cleaned$L_NEG_2[cleaned$L_NEG_2 == 4] <- 9
cleaned$L_NEG_2[cleaned$L_NEG_2 == 5] <- 10

cleaned$L_POS_1[cleaned$L_POS_1 == 1] <- 11
cleaned$L_POS_1[cleaned$L_POS_1 == 2] <- 12
cleaned$L_POS_1[cleaned$L_POS_1 == 3] <- 13
cleaned$L_POS_1[cleaned$L_POS_1 == 4] <- 14
cleaned$L_POS_1[cleaned$L_POS_1 == 5] <- 15

cleaned$L_POS_2[cleaned$L_POS_2 == 1] <- 11
cleaned$L_POS_2[cleaned$L_POS_2 == 2] <- 12
cleaned$L_POS_2[cleaned$L_POS_2 == 3] <- 13
cleaned$L_POS_2[cleaned$L_POS_2 == 4] <- 14
cleaned$L_POS_2[cleaned$L_POS_2 == 5] <- 15

cleaned$T_NEU_1[cleaned$T_NEU_1 == 1] <- 16
cleaned$T_NEU_1[cleaned$T_NEU_1 == 2] <- 17
cleaned$T_NEU_1[cleaned$T_NEU_1 == 3] <- 13
cleaned$T_NEU_1[cleaned$T_NEU_1 == 4] <- 18
cleaned$T_NEU_1[cleaned$T_NEU_1 == 5] <- 7

cleaned$T_NEU_2[cleaned$T_NEU_2 == 1] <- 16
cleaned$T_NEU_2[cleaned$T_NEU_2 == 2] <- 17
cleaned$T_NEU_2[cleaned$T_NEU_2 == 3] <- 13
```

```
cleaned$T_NEU_2[cleaned$T_NEU_2 == 4] <- 18
cleaned$T_NEU_2[cleaned$T_NEU_2 == 5] <- 7

cleaned$T_NEG_1[cleaned$T_NEG_1 == 1] <- 19
cleaned$T_NEG_1[cleaned$T_NEG_1 == 2] <- 20
cleaned$T_NEG_1[cleaned$T_NEG_1 == 3] <- 14
cleaned$T_NEG_1[cleaned$T_NEG_1 == 4] <- 9
cleaned$T_NEG_1[cleaned$T_NEG_1 == 5] <- 21

cleaned$T_NEG_2[cleaned$T_NEG_2 == 1] <- 19
cleaned$T_NEG_2[cleaned$T_NEG_2 == 2] <- 20
cleaned$T_NEG_2[cleaned$T_NEG_2 == 3] <- 14
cleaned$T_NEG_2[cleaned$T_NEG_2 == 4] <- 9
cleaned$T_NEG_2[cleaned$T_NEG_2 == 5] <- 21

cleaned$T_POS_1[cleaned$T_POS_1 == 1] <- 6
cleaned$T_POS_1[cleaned$T_POS_1 == 2] <- 17
cleaned$T_POS_1[cleaned$T_POS_1 == 3] <- 4
cleaned$T_POS_1[cleaned$T_POS_1 == 4] <- 14
cleaned$T_POS_1[cleaned$T_POS_1 == 5] <- 15

cleaned$T_POS_2[cleaned$T_POS_2 == 1] <- 6
cleaned$T_POS_2[cleaned$T_POS_2 == 2] <- 17
cleaned$T_POS_2[cleaned$T_POS_2 == 3] <- 4
cleaned$T_POS_2[cleaned$T_POS_2 == 4] <- 14
cleaned$T_POS_2[cleaned$T_POS_2 == 5] <- 15

video_data <- cleaned%>%
  pivot_longer(cols = L_NEU_1:T_POS_2,
               values_to = "speaker") %>%
  select(speaker)

#Video Lengths to Compute Mean and SD
video_length <- data.frame(
```

```
  length = c(26,40,60,33,50,
             45,58,58,43,31,
             38,36,60,36,43,
             40,60,58,34,51,
             59,48,45,34,33,
             38,55,48,32,45)
)
summary(video_length$length)
sd(video_length$length)

#Formatting Accuracy Dataframe
perceived_accuracy <- cleaned %>%
  mutate(id = c(1:31)) %>%
  select(id, starts_with("acc")) %>%
  pivot_longer(cols = -id,
               names_to = c("veracity", "valence", "measurment"),
               names_pattern = "acc_(\\w+)_(\\w+)_(\\d+)") %>%
  mutate(veracity = ifelse(veracity == "lie", "lie", "truth"),
         valence = ifelse(valence == "pos", "positive", ifelse(valence == "neg", "negative", "neutral")))
%>%
  select(id, valence, veracity, measurment, value) %>%
  rename(perceived_accuracy = value)
perceived_accuracy <- cbind(perceived_accuracy, video_data)
perceived_accuracy$id <- as.factor(perceived_accuracy$id)
perceived_accuracy$valence <- as.factor(perceived_accuracy$valence)
perceived_accuracy$veracity <- as.factor(perceived_accuracy$veracity)
perceived_accuracy$perceived_accuracy <- as.numeric(perceived_accuracy$perceived_accuracy)
perceived_accuracy$speaker <- as.factor(perceived_accuracy$speaker)

#Formatting Sender Impression Dataframe
sender_impression <- cleaned %>%
  mutate(id = c(1:31)) %>%
  select(id, starts_with("si")) %>%
  pivot_longer(cols = -id,
               names_to = c("veracity", "valence", "measurment"),
```

```
            names_pattern = "si_(\\w+)_(\\w+)_(\\d+)") %>%
  mutate(veracity = ifelse(veracity == "lie", "lie", "truth"),
         valence = ifelse(valence == "pos", "positive", ifelse(valence == "neg", "negative", "neutral"))) %>%
  select(id, valence, veracity, measurment, value) %>%
  rename(sender_impression = value)
sender_impression <- cbind(sender_impression, video_data)
sender_impression$id <- as.factor(sender_impression$id)
sender_impression$valence <- as.factor(sender_impression$valence)
sender_impression$veracity <- as.factor(sender_impression$veracity)
sender_impression$sender_impression <- as.numeric(sender_impression$sender_impression)
sender_impression$speaker <- as.factor(sender_impression$speaker)

#Formatting Valence Dataframe
perceived_valence <- cleaned %>%
  mutate(id = c(1:31)) %>%
  select(id, starts_with("val")) %>%
  pivot_longer(cols = -id,
               names_to = c("veracity", "valence", "measurment"),
               names_pattern = "val_(\\w+)_(\\w+)_(\\d+)") %>%
  mutate(veracity = ifelse(veracity == "lie", "lie", "truth"),
         valence = ifelse(valence == "pos", "positive", ifelse(valence == "neg", "negative", "neutral"))) %>%
  select(id, valence, veracity, measurment, value) %>%
  rename(perceived_valence = value)
perceived_valence <- cbind(perceived_valence, video_data)
perceived_valence$id <- as.factor(perceived_valence$id)
perceived_valence$valence <- as.factor(perceived_valence$valence)
perceived_valence$perceived_valence <- as.numeric(perceived_valence$perceived_valence)
perceived_valence$speaker <- as.factor(perceived_valence$speaker)

#Demographics
summary(cleaned$age_1_TEXT)
sd(cleaned$age_1_TEXT)
summary(cleaned$gender)
```

```
summary(cleaned$nationality)
summary(cleaned$education)
summary(cleaned$occupation)

#Descriptive statistics
perceived_accuracy %>%
  ggplot(aes(x = perceived_accuracy)) +
  geom_histogram(binwidth = 1, fill = "black", alpha = 0.8) +
  labs(x = "Perceived Accuracy Rating", y = "Frequency")
summary(perceived_accuracy$perceived_accuracy)
sd(perceived_accuracy$perceived_accuracy)

sender_impression %>%
  ggplot(aes(x = sender_impression)) +
  geom_histogram(binwidth = 1, fill = "black", alpha = 0.8) +
  labs(x = "Perceived Sender Impression Rating", y = "Frequency")
summary(sender_impression$sender_impression)
sd(sender_impression$sender_impression)
sender_impression %>%
  count(sender_impression)

perceived_valence %>%
  ggplot(aes(x = perceived_valence)) +
  geom_histogram(binwidth = 1, fill = "black", alpha = 0.8) +
  labs(x = "Perceived Emotional Valence Rating", y = "Frequency")
summary(perceived_valence$perceived_valence)
sd(perceived_valence$perceived_valence)

#Coreelations between DVs
acc <- perceived_accuracy %>% transmute(perceived_accuracy)
si <- sender_impression %>%  transmute(sender_impression)
val <- perceived_valence %>% transmute(perceived_valence)
complete <- cbind(acc, si, val)
cor.test(complete$perceived_accuracy, complete$perceived_valence)
```

```
cor.test(complete$perceived_accuracy, complete$sender_impression)
cor.test(complete$perceived_valence, complete$sender_impression)

#Analysis
library(lme4)
library(lmerTest)
library(emmeans)

model_acc <- perceived_accuracy %>%
  lmer(perceived_accuracy ~ valence*veracity + (1|id) + (1|speaker), data = .)
anova(model_acc)
summary(model_acc)

emmeans(model_acc, ~ valence * veracity)
emmeans(model_acc, ~ valence)
emmeans(model_acc, ~ veracity)

model_si <- sender_impression %>%
  lmer(sender_impression ~ valence*veracity + (1|id) + (1|speaker), data = .)
anova(model_si)
summary(model_si)

emmeans(model_si, ~ valence * veracity)
emmeans(model_si, ~ valence)
emmeans(model_si, ~ veracity)


model_val <- perceived_valence %>%
  lmer(perceived_valence ~ valence*veracity + (1|id) + (1|speaker), data = .)
anova(model_val)
summary(model_val)

emmeans(model_val, ~ valence * veracity)
emmeans(model_val, ~ valence)
```

```
emmeans(model_val, ~ veracity)

#Assumptions Check
library(modelr)
perceived_accuracy %>%
  add_residuals(model_acc) %>%
  ggplot(aes(x = resid)) +
  geom_histogram()

sender_impression %>%
  add_residuals(model_si) %>%
  ggplot(aes(x = resid)) +
  geom_histogram()

perceived_valence %>%
  add_residuals(model_val) %>%
  ggplot(aes(x = resid)) +
  geom_histogram()

perceived_accuracy %>%
  add_residuals(model_acc) %>%
  add_predictions(model_acc) %>%
  ggplot(aes(x = pred, y = resid)) +
  geom_point()

sender_impression %>%
  add_residuals(model_si) %>%
  add_predictions(model_si) %>%
  ggplot(aes(x = pred, y = resid)) +
  geom_point()

perceived_valence %>%
  add_residuals(model_val) %>%
  add_predictions(model_val) %>%
```

```
  ggplot(aes(x = pred, y = resid)) +
  geom_boxplot()

perceived_accuracy %>%
  add_residuals(model_acc) %>%
  add_predictions(model_acc) %>%
  ggplot(aes(x = valence, y = resid)) +
  geom_boxplot()

sender_impression %>%
  add_residuals(model_si) %>%
  add_predictions(model_si) %>%
  ggplot(aes(x = valence, y = resid)) +
  geom_boxplot()

perceived_valence %>%
  add_residuals(model_val) %>%
  add_predictions(model_val) %>%
  ggplot(aes(x = valence, y = resid)) +
  geom_boxplot()

perceived_accuracy %>%
  add_residuals(model_acc) %>%
  ggplot(aes(x = perceived_accuracy, y = resid)) +
  geom_point()

sender_impression %>%
  add_residuals(model_si) %>%
  ggplot(aes(x = sender_impression, y = resid)) +
  geom_point()

#Post Hoc Comparisons
simpleEffectsmain <- emmeans(model_val,  ~ valence, adjust = "tukey")
simpleEffectsmain
```

```
SEtestsmain <- joint_tests(model_val, by = "valence")
SEtestsmain
pairs(simpleEffectsmain,adjust='Tukey') %>% summary(infer = TRUE)

simpleEffects1 <- emmeans(model_val,  ~ veracity|valence, adjust = "tukey")
simpleEffects1
SEtests1 <- joint_tests(model_val, by = "valence")
SEtests1
pairs(simpleEffects1,adjust='Tukey') %>% summary(infer = TRUE)

simpleEffects2 <- emmeans(model_val,  ~ valence|veracity, adjust = "tukey")
simpleEffects2
SEtests2 <- joint_tests(model_val, by = "veracity")
SEtests2
pairs(simpleEffects2,adjust='Tukey') %>% summary(infer = TRUE)

#Interaction Plots
bar1 <- as.data.frame(confint(simpleEffects1))
bar1$perceived_valence <- as.numeric(simpleEffects1$emmeans)
bar1$veracity <- as.factor(simpleEffects1$trms[[1]]$veracity)
bar1$valence <- as.factor(simpleEffects1$trms[[2]]$valence)

bar1 %>%
  ggplot() +
  aes(x = valence, y = emmean, fill = veracity) +
  geom_bar(aes(group = veracity),
           position=position_dodge(),
           stat="identity") +
  geom_errorbar(aes(ymin=emmean-1.96*SE, ymax=emmean+1.96*SE),
                position=position_dodge()) +
  labs(x = "Emotional Valence", y = "Mean Perceived Emotional Valence") +
  scale_fill_manual(values = c("#333333", "#CCCCCCCC"), name = "Veracity",
                    labels = c("Truth", "Lie"))
```

```
bar2 <- as.data.frame(confint(simpleEffects2))
bar2erceived_valence <- as.numeric(simpleEffects2$emmeans)
bar2$veracity <- as.factor(simpleEffects2$trms[[1]]$veracity)
bar2$valence <- as.factor(simpleEffects2$trms[[2]]$valence)


bar2 %>%
  ggplot() +
  aes(x = veracity, y = emmean, fill = valence) +
  geom_bar(aes(group = valence),
           position=position_dodge(),
           stat="identity") +
  geom_errorbar(aes(ymin=emmean-1.96*SE, ymax=emmean+1.96*SE),
                position=position_dodge()) +
  labs(x = "Veracity", y = "Mean Perceived Emotional Valence") +
  scale_fill_manual(values = c("#333333", "#999999", "#CCCCCCCC"), name = "Emotional Va-
lence",
                    labels = c("Negative", "Neutral", "Positive"))
```

Appendix C: Linear Assumptions

Figure C1

Distribution of Ratings of Perceived Accuracy

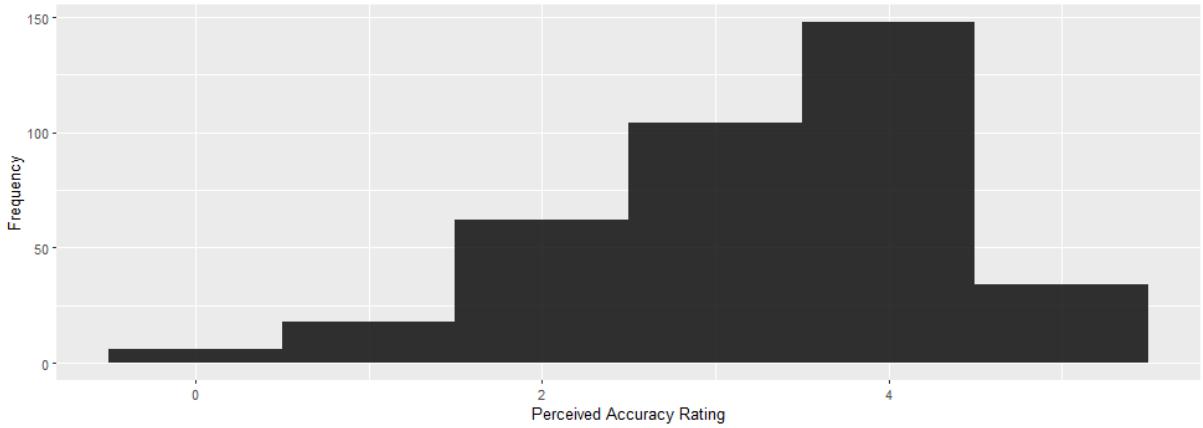

Figure C2

Distribution of Ratings of Perceived Sender Impression

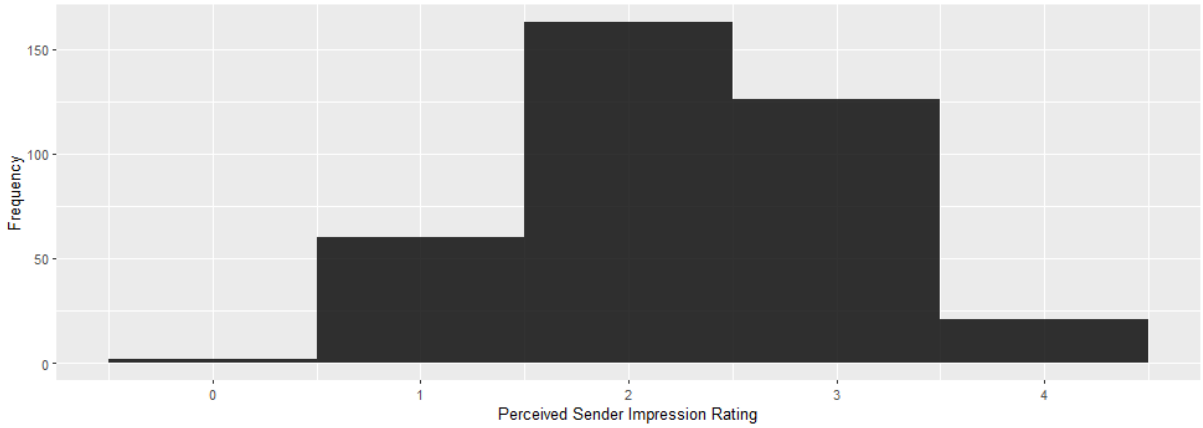

Figure C3

Distribution of Ratings of Perceived Emotional Valence

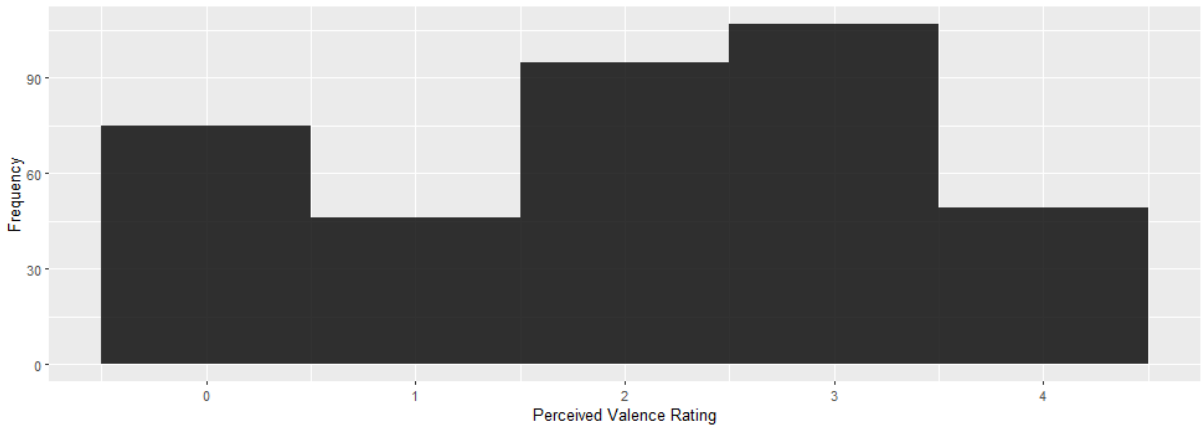

Figure C4

Histogram of the Residuals in the Perceived Accuracy Model

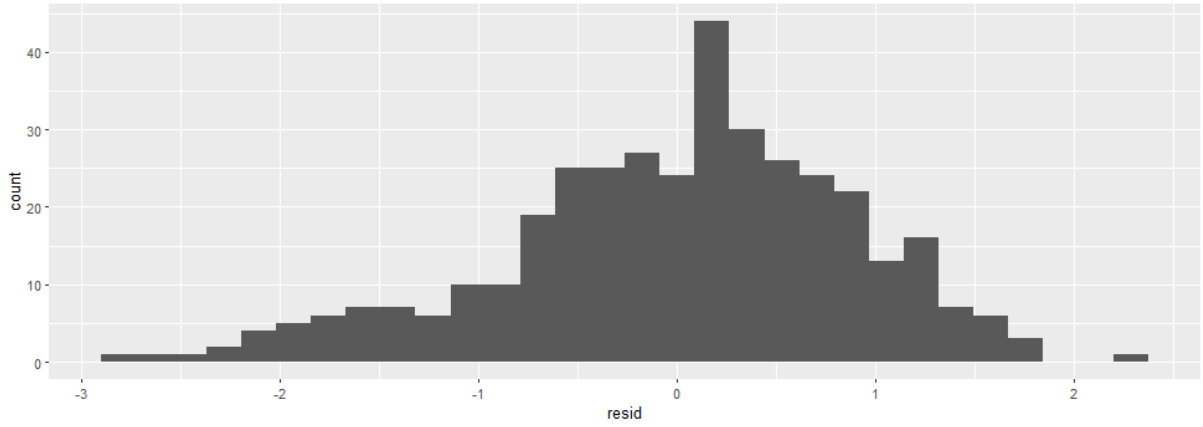

Figure C5

Histogram of the Residuals in the Sender Impression Model

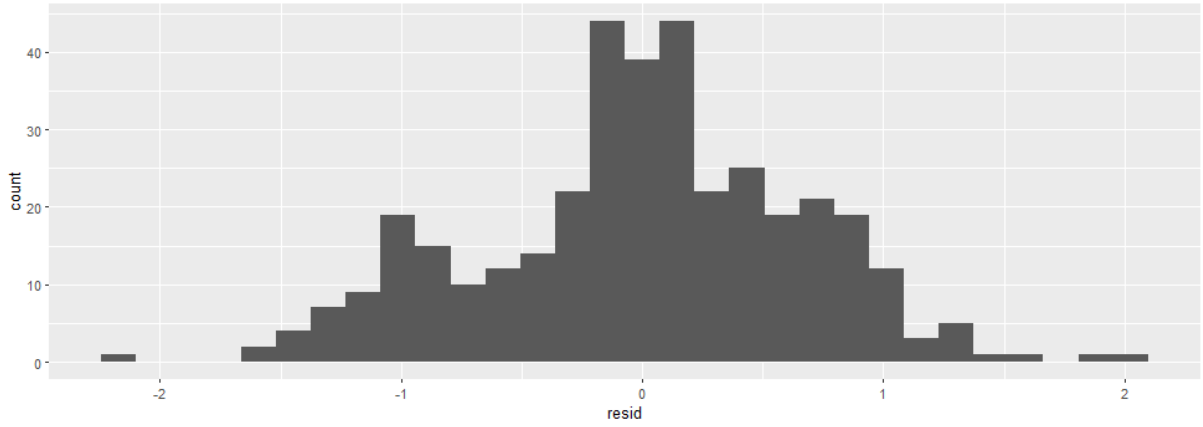

Figure C6

Histogram of the Residuals in the Perceived Emotional Valence Model

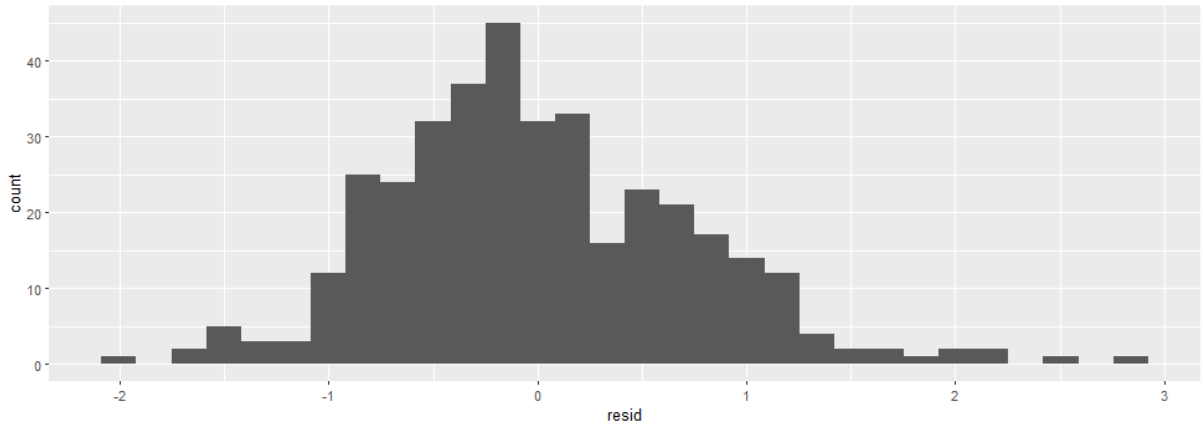

Figure C7

Boxplots of the Residuals for Each Level of Emotional Valence in the Perceived Accuracy Model

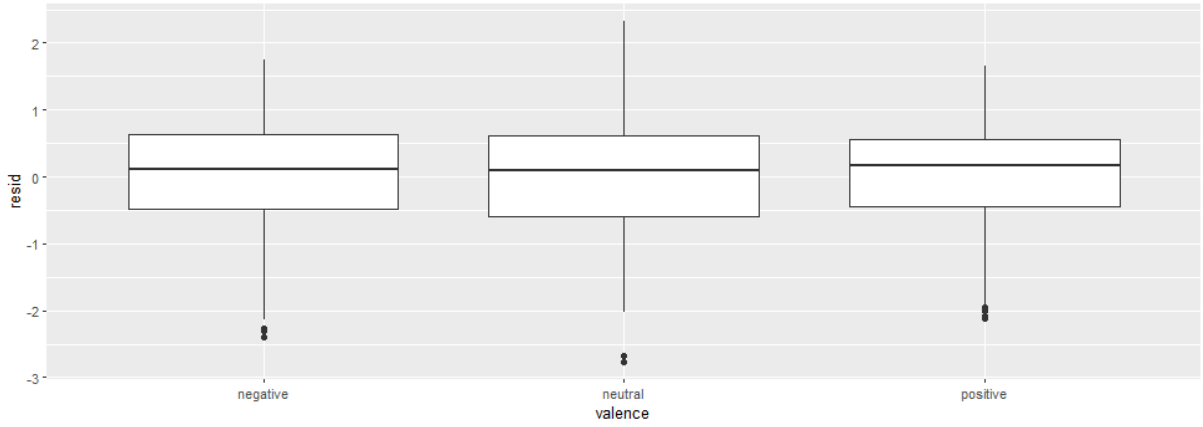

Figure C8

Boxplots of the Residuals for Each Level of Emotional Valence in the Sender Impression Model

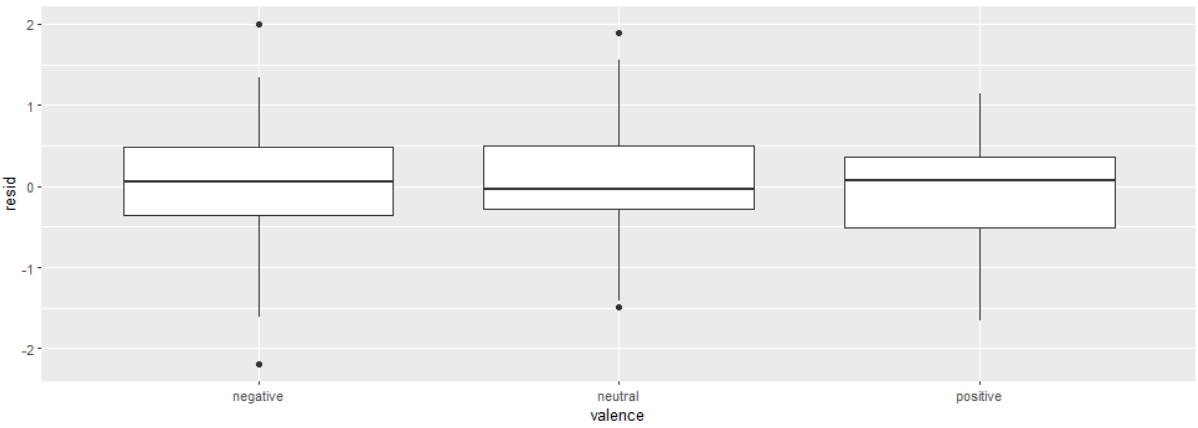

Figure C9

Boxplots of the Residuals for Each Level of Emotional Valence in the Perceived Emotional Valence Model