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Authors	Pollmann, Monique; Roos, C.A.
Published in	Computers in Human Behavior Reports
DOI	10.1016/j.chbr.2025.100689
Publication Date	2025-05
Link	https://research.tilburguniversity.edu/en/publications/8dc59c6d-56d1-4f08-b775-7c3a9aa5d39a
Citation	Pollmann, M & Roos, C A 2025, “I get u”. People correctly interpret the tone of text messages and emails’, Computers in Human Behavior Reports, vol. 18, 100689, pp. 1-10. https://doi.org/10.1016/j.chbr.2025.100689
Download Date	2025-10-14 19:51:17
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“I get u”. People correctly interpret the tone of text messages and emails[☆]

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ARTICLE INFO

Keywords:

Online communication
Text messages
Emails
Emotion
Valence

ABSTRACT

It has often been assumed that receivers interpret the emotional tone of a text-based message differently and often more negatively than intended by the sender. It is unclear, however, whether this is true in everyday online conversations between non-strangers. We therefore tested this by comparing sender and receiver ratings of text messages exchanged in an informal context (Study 1) and emails exchanged in a work or educational context (Study 2). In both studies, we asked participants ($N_{\text{Study1}} = 347$; $N_{\text{Study2}} = 361$) to rate the valence of a message they received and asked the sender of that message ($N_{\text{Study1}} = 171$; $N_{\text{Study2}} = 61$) to report the intended valence of the message. We tested six possible moderators: (1) the length of the message, (2) the use of emoji, (3) the gender of the receiver, (4) the age of the receiver, (5) the social closeness between sender and receiver, and (6) the degree of neuroticism of the receiver. In both studies, we find no indication for misunderstanding as receivers' and senders' valence ratings align very well. We also find no evidence for moderation effects. This shows that, in the context of everyday text messages and emails, people are able to correctly interpret the emotional valence of a text-based message. This finding challenges the popular assumption of prevalent online misunderstanding and provides empirical support for the idea that people can and do successfully adapt their communication style to accurately convey the emotional tone in text-based messages.

There is a widespread belief, among scientists and laypeople alike, that online communication is more prone to misunderstanding than face-to-face communication (FtF). Online messages are assumed to be understood differently, and often more negatively, than intended (Kelly et al., 2012; Kelly & Miller-Ott, 2018). The proposed reason is that text-based online communication contains fewer social cues, such as non-verbal signals and tone of voice, and missing or misinterpreted context which might be conducive to miscommunication (Daft & Lengel, 1986; Kelly et al., 2012; Ritter, 2015). However, Derks and colleagues (2008a) concluded in their review on emotions in online communication that it is unclear whether people indeed misinterpret emotions in online communication and that research on this “potential danger” is lacking.

Today, it still has not been studied whether there is indeed (negative) misunderstanding in real-life everyday text-based communication. The research that has been done on online miscommunication has compared the message evaluation by receivers with that of objective raters rather than message senders (e.g. Sillars & Zorn, 2021), has looked at misinterpreted emotions in a lab context rather than in real-life (Kruger et al., 2005), or has measured people's experience of misunderstanding after an online chat episode rather than their actual misunderstanding of

individual messages (Roos et al., 2020). Notably, studies that investigated real-life conversations suggest that online communication is not associated with more serious misunderstandings (Edwards et al., 2017) and even that online communication is as well-suited for conflict resolution as FtF communication (Pollmann et al., 2020). It may be that people can effectively adapt to the limitations of the medium to prevent misunderstanding. This has been shown to happen in studies on initial encounters when people are motivated to build a relationship (Antheunis et al., 2007; Walther, 1996). The same may hold for everyday interactions, enabling people to correctly interpret each other's emotional tone in online communication. But whether this is the case is still an open question.

In the current paper, we therefore investigate to what extent senders and receivers agree on the valence of an online text-based message. We go beyond previous research by studying everyday text messages exchanged in an informal context and emails exchanged in a work or educational context, and by including dyadic data in the form of ratings from both message senders and receivers.

[☆] We thank Nonja van Zuilen, Nienke Koning, and Carlijn de Vaan for collecting part of the data and Jade van Tilburg for helping check the screenshots.

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<https://doi.org/10.1016/j.chbr.2025.100689>

Received 10 October 2024; Received in revised form 5 May 2025; Accepted 8 May 2025

Available online 16 May 2025

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1. Reduced cues in text-based communication

There is a long history of online communication research focusing on reduced social cues compared to FtF conversations. The classic and still influential Social Presence Theory (Short et al., 1976), Media Richness Theory (Daft & Lengel, 1986), and the lack of social context cues hypothesis (Sproull & Kiesler, 1986) all emphasize that text-based communication lacks non-verbal and paralinguistic cues, and this is problematic because these non-textual cues are required to communicate effectively. The receiver of a message needs cues like the sender's gestures, facial expressions, and tone of voice, to provide them with the contextual information they need to correctly understand the sender's message (Krason et al., 2024; Kruger et al., 2005).

Besides missing non-textual cues, the shortness of text-based messages might make them more easily misunderstood than FtF statements (Roos et al., 2024). This is especially problematic in the context of negative messages, such as a rejection or disagreement. When delivering a negative message, people in FtF conversation are likely to communicate more indirectly, ambiguously, or evasively (Brown & Levinson, 1987; Sussman & Sproull, 1999). They use disclaimers ("I'm not sure"), qualifiers ("maybe", "sort of"), and hedges ("ehm") to avoid direct confrontation and prevent conflict. In online group discussions, people tend not to use such strategies, and instead tend to formulate their opinions more briefly and directly than they would in FtF communication (Roos et al., 2020). This directness of text-based messages is inherent in the medium but has the potential to damage interpersonal harmony by being misattributed to a lack of social concern for others. That is why text-based messages may be perceived differently and more negatively than intended.

It is not only negative messages that are affected, also positive messages may be misunderstood, because they lose some of their positivity (Byron, 2008). Kelly and Miller-Ott (2018) studied a sample of 295 texted miscommunications that participants sent in and explained why it was a miscommunication. Eighteen percent of these were classified as a misinterpretation of humor or sarcasm. The misunderstandings arose because the conversation partner did not catch the playful tone of the message and interpreted it more negatively than intended. These findings are further supported by an experimental study that found that people overestimate how well they can convey humor via email (Kruger et al., 2005, Study 5). In this study, participants were asked to email five jokes to another participant. The senders rated how funny they found the joke and how funny they thought the receiver of the email would find it. The senders strongly overestimated how funny the receiver would find the joke. This indicates that text-based messages that are meant to be positive and funny can be misunderstood to some extent.

Another reason for misunderstanding in online communication is missing context. Illustrative here is a study on business email communication (Sillars & Zorn, 2021) in which people were asked to provide an example of an email that they perceived as negative. On 7-point semantic differential scales measuring negativity (e.g. respectful-disrespectful), the receivers of the emails rated them as 5.09. The emails were also rated by objective observers on the same scale and the observers rated them as 4.5. Strictly speaking, this was not a test of misunderstanding, which would be defined as the difference between "the extent to which a receiver's perception differs from the sender's intent" (Byron, 2008), and here the sender was not involved. Nevertheless, the significant difference between receiver and observer ratings indicates that negative email messages may appear more negative to the receiver than intended. The authors explain the difference with the fact that many emails did not contain overt negativity. The receiver interpreted the email negatively based on the context in which it was sent, which was unknown to the objective raters. This shows that the meaning of (online) communication lies not only in the words themselves, but also in the perceived context in which they are used.

2. Emotion in online communication

Taking all of the above together, one may conclude that there is a general tendency - due to missing cues, shorter messages, and/or missing context - to perceive text-based messages differently, and often more negatively, than they are intended by the sender. However, it should be noted that the mentioned studies focus on specific circumstances. They concern reports of people who were explicitly asked to talk about miscommunication in texting, emails that were pre-selected to be examples of a negative message, funny statements that are very hard to get across via text only, and lab settings where groups of strangers discussed controversial topics. Whether these effects translate to everyday text-based communication is an open question. Text-based online communication is very common and people have a lot of experience with it. According to the social information processing (SIP) theory (Walther, 1992), people learn to adjust their communication to new media and learn to successfully get their message across.

According to SIP theory (Walther, 1992), people compensate for the lack of non-verbal cues in text-based communication with other cues (e.g. emoticons, more disclosure) to build a relationship with their conversation partner. In line with this idea, people who get to know each other using online communication achieve similar levels of liking and attraction than people who meet in person (Antheunis et al., 2007; McKenna et al., 2002). Although this theory was formulated for new encounters, its main idea, that people enrich their communication when using online media, may also hold for established relationships. Thus, by using emoticons and other stylistic features people may successfully convey the emotional tone of their message. In a recent experimental study on the accuracy of conveying messages via text, the receivers even perceived the valence of a message as more positive than intended by the sender (Holtgraves, 2021). The text messages that were conveyed in that study were potentially face threatening and the senders, in an attempt to soften the threat, wrote more positive messages than intended. Thus, people may adjust their messages to compensate for the possibility that text messages can appear more negative than intended.

Moreover, earlier studies investigated interactions between strangers, but friends or colleagues may be better able to get the tone of a message right because they know each other's background and the context in which the message was written. To illustrate, the external observers who read the 'negative' emails in the study mentioned earlier (Sillars & Zorn, 2021), sometimes missed the context to understand why an email was perceived as offensive. The authors provided an example email that included the sentence: "All staff will be required to work a minimum of two Sundays per month.". One needs to know that the receiver is a spiritual person who goes to church on Sundays to understand how it is perceived by that person. Friends and colleagues know each other better, so they should be able to put their messages into context.

Taken together, there are indications that text-based messages are perceived more negatively than intended, but in a natural context involving existing relationships, senders will likely adjust their messages and senders will be able to put the message into context such that the valence will be correctly conveyed and correctly interpreted. Based on these insights we predict that in everyday text messages and emails, the valence as intended by the sender will not differ from the valence that is perceived by the receiver.

3. Possible moderators of online misunderstanding

There are several factors that may improve or impair the correct interpretation of online messages (Byron, 2008). In the following, we will discuss literature that looks at the influence of (1) the use of emoticons, (2) the gender of the sender, (3) the gender of the receiver, (4) the age of the receiver, (5) the degree of neuroticism of the receiver, (6) the social closeness between sender and receiver, and (7) the length of the message. We do not formulate specific hypotheses for these moderators

because for most of them there is no clear evidence pointing in a certain direction and none of them was studied in the context of natural messages.

- (1) Emoticons/Emoji - Emoticons can strengthen the emotional tone of a message, especially when it concerns a positive message (Derks, Bos, & Von Grumbkow, 2008). Two experimental studies with manipulated messages consistently found that a positive message accompanied by a smiling emoticon is perceived as more positive than a positive message alone but that a negative message with a frowning emoticon is not rated more negatively than a negative message alone (Walther & D'Addario, 2001; Derks, Bos, & Von Grumbkow, 2008). Although these studies show that emoticons can also increase ambiguity (when using inconsistent emoticons), most emoticons that are used are positive, as content analyses of texts show (Halverson et al., 2023). Given that text-based messages are most likely misunderstood in the direction of an overly negative interpretation, the use of emoji could contribute to a more accurate understanding.
- (2) Gender of the sender - In online communities, using text mining and automatic sentiment analyses, it has been found that women express more positive emotions than men (Thelwall et al., 2010; Sun et al., 2020). In a vignette study using ambiguous text messages (e.g. "You text a friend to tell him/her you got offered a great job. S/he replies: Good for you") Kingsbury and Coplan (2016) found that participants interpret a message more negatively if they think the sender was female. In a natural setting, these two effects may even out: females write more positively, but texts from females are interpreted more negatively. Because the context of these studies is very different from the natural setting that we will investigate and the results are inconsistent, it is not clear in what direction the gender of the sender may influence the interpretation.
- (3) Gender of the receiver - A gender difference has also been found for receivers of a message. According to research on the interpretation bias, women tend to interpret socially ambiguous information somewhat more negatively than men (Kingsbury & Coplan, 2016). The interpretation bias is measured with vignettes like: "You send a text to friend, to ask whether he/she is free to talk on the phone and the friend replies: 'maybe later'". This can be interpreted as 'my friend has no time right now, but wants to talk later' or 'he/she does not want to talk to me'. When asked about the likelihood that the negative interpretation would come to mind, women tend to give somewhat higher scores than men (Kingsbury & Coplan, 2016). Based on this finding it may be that women generally interpret the message, but this is based on a single study and the effect was rather weak.
- (4) Age of the receiver - Byron (2008) theorized that older people are more likely to interpret an email more negatively than intended because they are not used to expressing emotions in textual form. Regarding texting, older adults have fewer experience with texting than younger adults (Forgays et al., 2014). Younger adults (18–24 years old) send and receive more texts, expect faster responses, and are more likely to break up via text than older adults (25–34 years old). Given that younger adults have more experience with texting they may also be more tuned in to the emotional content of a message and therefore be able to perceive it more accurately. We do not specifically sample different age groups, so we do not expect age to have a large effect in our studies.
- (5) The degree of neuroticism of the receiver - People who score higher on neuroticism have a higher general tendency to experience negative affective states. They may therefore be more likely to interpret messages negatively (Byron, 2008). Findings by Finn and colleagues (2013) supports this claim and shows that people who score higher on neuroticism are more likely to

interpret ambiguous relationship information (e.g. "Your partner has not told you he/she loves you for a while.") as negative ("he/she does not love me anymore, or is in doubt"). Another study showed the same link for more general social scenarios like how to interpret the fact that people in the audience are laughing during one's speech at a wedding (Vinograd et al., 2020). Given that text-based messages have a large potential to be ambiguous, people who score high on neuroticism may also be more likely to interpret text-based messages as more negative than intended by the sender.

- (6) Social closeness - One might think that people with a closer relationship are better able to understand each other as they have shared knowledge and have knowledge about each other's emotional state. Indeed, research on empathic accuracy showed that male friends outperformed male strangers in an empathic accuracy task (Stinson & Ickes, 1992). In this task, two people have a video-taped conversation and are later asked to watch the tape and mark time points in which they had a certain thought or feeling. The other person is then asked at each of the time points to guess what the thought or feeling was. The fact that friends outperform strangers indicates that friends are better able to read their emotions. But whether this translates to texting, where the conversation partners cannot see each other, is an open question.

Another process that is relevant here is the fact that people use more similar language the more they communicate. This has been described in the communication accommodation theory (Giles & Ogay, 2007) and has been investigated as language style matching (Gonzales et al., 2010). In text-based communication, language style matching can occur, for example, if people start using similar textisms (emoji, capitalizations, etc.). In a sample of natural text messages it has been found that the number of textisms used by conversation partners significantly correlates (Adams et al., 2018). Arguably, conversation partners should understand each other better if they use similar textisms. On the other hand, language style matching occurs between strangers to the same extent as between friends (Cannava & Bodie, 2017) and several studies show that friends do not communicate more correctly or more efficiently than strangers or acquaintances, they only *think* they do (Kruger et al., 2005; Pollmann & Krahmer, 2018; Savitsky et al., 2010). So it is not clear whether people who have a closer bond are indeed more accurate in perceiving the emotional tone of a text-based message.

- (7) Length - Finally, we include the length of the message in our analyses. We assume that short responses like 'ok' or 'yes' are more ambiguous than more elaborate responses. With more ambiguity, messages are more prone to the interpretation bias (Kingsbury & Coplan, 2016), which means that the response is more negatively perceived. To illustrate, Holtgraves et al. (2023) asked people to provide examples of text-based miscommunication, and this was one of the examples: "K./are you mad??/no why?/you just sent K.". The very short reaction is interpreted as a sign of negative valence and there are not enough cues in the message to resolve the ambiguity.

4. The present study

In the present paper, we examined in two studies how the valence of a message is intended by the sender and how it is perceived by the receiver. For this, we used actual text-based messages: smartphone texts in Study 1 and emails in Study 2. In both studies, we asked both the message sender and the receiver to judge the valence of the text/email message. With this design, the study is an important addition to the literature which has often focused on either the sender (Wells & Dennis, 2016) or the receiver (Edwards et al., 2017; Sillars & Zorn, 2021) or studied manipulated messages between unacquainted dyads in the lab (Hancock et al., 2007; Sussman & Sproull, 1999).

5. Study 1

5.1. Method

5.1.1. Participants

We recruited participants from three sources. The first was a subject pool in Communication Science at a Dutch university who participated in exchange for course credit. The second was the personal network of a research assistant (in the Netherlands) who participated without payment. The third source was Prolific - a worldwide online platform for the recruitment of paid participants (UK, USA, Netherlands). The participants on Prolific received .9 British pounds and an additional 1 British pound if the sender responded. The survey was written in English, and the screenshots of participants' text messages could be in English or Dutch. We advertised the study as a study about WhatsApp or similar texting services. We call the participants we recruited 'receivers' and their friends the 'senders', as we asked participants to send us a screenshot of a conversation in which they asked a friend to do something together and the reply of the friend was the message of interest for which we collected the valence ratings. In total, 349 people finished the survey, but two people did not follow the instructions to select a message that their friend reacted to, so they were excluded. The mean age of the 347 remaining receivers was 29.72 years ($SD = 11.26$ years) and the gender distribution was as follows: 213 female, 131 male, 1 other, 2 prefer not to say. We received 176 responses from the sender, but 5 of them provided the wrong identification code, so we could not match them to a receiver. This means that the sample consisted of 171 cases in which we had both sender and receiver ratings. The mean age of the receivers in this subsample was 28.28 ($SD = 10.13$) and the gender distribution was: 113 female, 57 male, 1 other. The mean age of the senders was 29.33 ($SD = 10.73$) and the gender distribution was: 103 female, 67 male, 1 'prefer not to say'. Taking into account only dyads in which both members identify as either female or male results in 41 male-male dyads, 42 mixed-sex dyads, and 86 female-female dyads.

5.1.2. Procedure and materials

The study was approved by our ethical board and participants started by giving their informed consent. They were informed that the study would be about an actual texting conversation they had had with someone and that we would ask them to send us a screenshot of the conversation. We explicitly stated that we would only look at the screenshot if the sender also gave their consent to do so.

The survey started with demographic questions, followed by the instructions to search one's smartphone for a conversation with a friend in which they asked the other person to do something social and the other person responded. We chose this context because it has been used before in studies on the misinterpretation of text-based messages (Kingsbury & Coplan, 2016) and we assumed that this is a common question that can be answered with a confirmation or a refusal, so there is a broad spectrum of how the answer is formulated and interpreted. Participants were asked to prepare the screenshot by blackening all personal information and then uploading it. We then asked the following questions about the conversation: (1) "How many days ago did the conversation take place?". (Open question) (2) "Did your friend's response contain one or more emoji?" (1 = yes, 2 = no). (2b) "Which emoji did your friend send?" (Open question). (3) "Out of how many characters did your friend's response consist?" (with instructions to count all letters, spaces, and punctuation marks and include the whole response, even if it is divided over several messages.). (4) "Think back to the moment you received the response. At that moment, how positive or negative did you think your friend responded to your question?" (1 = extremely negative, 9 = extremely positive).

We then measured neuroticism with the neuroticism subscale of the "Big Five Inventory" (John & Srivastava, 1999). This scale consists of eight statements, e.g. "I see myself as someone who is depressed, blue" that were answered on a 7-point scale ranging from 1 = "Strongly disagree" to

7 = "Strongly agree". The average neuroticism score was 3.33 ($SD = 1.12$) and the scale had a good reliability ($\alpha = .87$). Next, we measured closeness with the friend with the "Unidimensional Relationship Closeness Scale" (Dibble et al., 2012). This scale consists of twelve statements like: "My relationship with this person is close" that were answered on a 7-point scale ranging from 1 = "Strongly disagree" to 7 = "Strongly agree". The average closeness score was 5.02 ($SD = 1.21$) and the scale had a good reliability ($\alpha = .95$).

In order to match the responses from the participant and the friend, we asked the participant to generate an identification number consisting of the two digits of the day they were born, the first two digits of their house numbering and the last two digits of their phone number. Finally, we asked the participants to send the friend an invitation to a short survey so that the friend could give their consent and rate the valence of the message they sent. We provided them with the following text, but participants were free to formulate their own message:

"Hi! I have participated in a survey regarding text messages and I've sent in this screenshot of our conversation, with all our identifiable information cropped or blacked out. Would you mind answering some questions about our screenshotted conversation? The survey will take less than 5 min! You will have to fill in this identification number (insert number here). Here is the link to the survey: xxx. Thank you!"

The survey for the friend consisted of five questions: (1) informed consent, (2) the identification number, (3) the valence rating: "Your friend sent you a screenshot of a conversation between the two of you. Your friend asked you to do something social together. Please take a look at your response to your friend's question in this conversation. Think back to the moment you sent this response. At that moment, how positively or negatively did you intend to reply to your friend with this message?" (1 = extremely negative, 9 = extremely positive), (4) age, and (5) gender (male, female, other, rather not say).

We checked the 171 screenshots that we were allowed to open to see whether they met the requirements (containing a question to do something together and a response to that). 146 of the screenshots clearly did (e.g. "So are we going over to [blank] tonight? 🍷" "Hey - I don't know yet - I am feeling sick a bit - You should go without me if I cant make it". For the remaining 25 we had some doubts (e.g. "Ben je gwn thuis vanmiddag - "ben thuis man gwn" [Are you at home this afternoon? - Am home]). As it is sometimes hard to interpret the conversation from a restricted screenshot, we decided that the participants themselves are the best judges of the suitability and included all 171 cases in the main analysis. In the supplement materials, we present the results for the 146 messages that fully meet our criteria according to our judgment. These led to the same conclusions.

5.2. Results

5.2.1. Descriptive statistics

In the sample of 347 responses from the receiver, they reported that the senders' responses were on average 58.15 characters long ($SD = 77.47$) and 97 (28 %) contained an emoji. One response was 1000 characters long, which was an extreme outlier and an unrealistic answer, so we decided to trim this response and replace it with the second highest score (408). This reduced the mean length to 56.42 ($SD = 61.28$). The conversation took place on average 34 days ago ($SD = 103.30$), but this value was heavily influenced by a few outliers; the median was only 8 days. The average perceived valence was 7.34 ($SD = 1.43$). In the subsample of which we have both receiver and sender ratings ($n = 171$), the responses were on average 52.43 characters long ($SD = 54.60$) and 46 (27 %) contained an emoji. The average perceived valence of these responses on the 9-point scale was 7.25 ($SD = 1.49$) and the average intended valence was 7.39 ($SD = 1.40$). The correlations between our variables can be found in Table 1. Here we see that receiver and sender valence ratings are significantly correlated ($r = .33$, $p < .001$), indicating that there is agreement about the valence of the

Table 1
Correlations between the key variables of Study 1.

	1	2	3	4	5	6	7	8
1) Age receiver								
2) Gender receiver (0 = female)	.22***							
	338							
3) Closeness	-.05	-.25***						
	340	341						
4) Length message	.16**	-.07	-.09					
	336	339	339					
5) Emoji (0 = no)	.05	-.03	-.04	.23***				
	341	342	344	340				
6) Neuroticism receiver	-.22***	-.22***	.11	-.03	.06			
	341	342	344	340	345			
7) Valence rating receiver	.07	-.13*	.06	.08	.09	-.05		
	341	342	344	340	345	345		
8) Valence rating sender	.04	-.05	-.01	-.04	.04	-.03	.33***	
	165	168	169	169	169	169	169	
9) Valence difference	-.01	.07	-.02	-.08	-.04	.02	-.61***	.54***
	165	168	169	169	169	169	169	169

Note. The first number represents Pearson’s *r*, the second number represents the degrees of freedom. The valence difference is calculated as the rating of the sender minus the rating of the receiver. The levels of the categorical predictors are: gender receiver ((0 = female, 1 = male), Emoji (0 = absent, 1 = present).

message. We also see some correlations, like the correlations between gender and neuroticism, that are not relevant for our study, but are consistent with earlier research (Soto et al., 2011).

5.2.2. Comparison between sender and perceiver valence ratings

We first compared the intended valence with the perceived valence with a paired samples *t*-test. We found no significant difference between the valence as intended by the sender ($M = 7.39, SD = 1.40$) and the valence as perceived by the receiver ($M = 7.25, SD = 1.49$), $t(170) = -1.05, p = .29, d = .08$. The difference score was not normally distributed because there was significant kurtosis in the data ($z\text{-score} = 6.54$). Our sample size is big enough to rely on the central limit theorem, so the *t*-test should be reliable, but to be sure we also calculated the Wilcoxon rank test, which showed that the mean rank difference was 0, so there was no significant difference $W = 3002.5, p = .33$.

Given that we hypothesized that there is no effect, the actual test of our hypothesis is an equivalence test. We used the TOSTER module in jamovi which showed that we can rule out an effect in either direction that is larger than half a point (on our 9-point scale): TOST Lower = $t(170) = 4.97, p < .001$, TOST Upper = $t(170) = 2.86, p = .002$. We can conclude that receivers are quite accurate in perceiving the valence of a text message, which is in line with our hypothesis.

5.2.3. The role of age, gender, emoji, message length, neuroticism, and closeness

Next, we tested whether any of the proposed moderators influences the difference between sender and receiver ratings. Even if there is no main effect, it may be disguised by a moderator. For example, it may be that people perceive messages with an emoji as more positive than intended and messages without an emoji as more negative, which would result in a null effect for the overall sample. To test the role of the moderators, we first calculated the difference score between the intended and the perceived valence. Larger scores on this variable indicate an overly negative perception of the message. For example, if the sender intended the response to be a 9 and the receiver perceived it to be a 7, the difference score would be 2. If the sender intended the response to be a 5 and the receiver perceived it to be a 6, the score would be -1, indicating an overly positive perception.

We used the difference score as outcome variable in a regression analysis with age, gender of both sender and receiver (only male and female), emoji, message length, neuroticism, and closeness as predictors. This model was not significant, $R^2 = .03, F(7, 157) = .56, p = .78$, indicating that neither age, nor gender, nor the presence of an emoji, nor the length of the message, nor the tendency of the receiver to perceive things negatively, nor the closeness between sender and

receiver are related to whether the message is interpreted as overly positive or negative. We should note that the residuals of this model were not normally distributed ($z\text{-score kurtosis} = 6.22$), so this is a limitation of the model.

5.2.4. Perceived valence

Next, we performed a similar regression analysis, but with the perceived valence of the receiver as outcome variable. This allowed us to include all 347 responses, having more power to detect what influences how positive a message is perceived. This analysis does not directly test any misalignment, but simply whether age, gender of the receiver (only male and female), emoji, message length, neuroticism, and closeness can predict how positive people perceive a message. We don’t know in this case whether the valence is perceived correctly, but we can test which circumstances make the perception of a message more negative or positive in general. This regression model was significant, $R^2 = .04, F(6, 329) = 2.53, p = .02$. The effect of the individual predictors can be found in Table 2. As can be seen there, only the gender of the receiver had a significant association with the perception of the message. Women rated the messages they received as more positive ($M = 7.48, SD = 1.32$) than males did ($M = 7.11, SD = 1.57$). Again, the residuals of the model were not normally distributed ($z\text{-score skewness} = -8.89, z\text{-score kurtosis} = 6.45$), which limits the extent to which the model can be generalized.

5.3. Discussion

This first study shows that there is no indication that people perceive text messages as more negatively than they were intended by the sender. To see whether this also holds in a different context, we conducted a second study where we investigated email messages.

Table 2
Outcomes of the regression model predicting the perceived valence of the message.

Predictor	Estimate	standardized Estimate	SE	<i>t</i>	<i>p</i>
Intercept	6.697		.473	14.170	<.0001
Gender: female - male	.419	.29	.172	2.434	.0155
Emoji: Yes - No	.235	.16	.177	1.329	.1848
Age	.010	.08	.007	1.445	.1494
Closeness	.059	.05	.066	.891	.3734
Neuroticism	-.112	-.09	.072	-1.564	.1188
# of characters in message	.001	.05	.001	.940	.3479

6. Study 2

6.1. Method

6.1.1. Participants

We recruited participants from the personal network of two research assistants (the Netherlands) who participated without payment, and from Prolific (UK, USA, the Netherlands) who received 1.3 British pounds and an additional 1 British pound if the sender responded. We advertised the study as a study about email communication. We received 361 complete responses from the receivers and 61 from the senders. The mean age of the receivers was 32.07 years ($SD = 12.11$ years) and the gender distribution was as follows: 174 female, 185 male, 2 'prefer not to say'. The mean age of the senders was 38.72 ($SD = 11.81$) and the gender distribution was: 28 female, 32 male, 1 'prefer not to say'.

6.1.2. Procedure and materials

The study was approved by our ethical board and preregistered under <https://aspredicted.org/hb4x-hbypc.pdf>. Participants started by giving their informed consent. They were informed that the study would be about an email exchange they had had with someone and that we would ask them to make a screenshot of the conversation. The email needed to be an email that they received from a person in a work or school context (in a work context: a coworker, colleague, supervisor, or other work-related person. In a school context: a student or teacher) and should include either feedback on something, a response to a request, or an answer to a question. We also specified that the email should contain no personal details, be written in English, Dutch, or German, as recent as possible, and that the participant should feel comfortable sending the screenshot to the sender and (in the prolific sample only) to upload the screenshot. We explicitly stated that we would only look at the screenshot if also the sender gives their consent to do so.

The surveys used in the two samples differed somewhat. The Prolific survey was designed to be equal to Study 1, but the other survey included some additional questions, excluded questions about the length of the email and neuroticism, and did not ask participants to upload the screenshot. Apart from that, the surveys were equal.

The surveys started with questions about gender and age, followed by the instructions to search an email that fit the criteria as described above. We made the context broader than in Study 1 to make the results representative of everyday email exchanges. Participants in the prolific sample were asked to prepare the screenshot by blackening all personal information and then uploading it. We then asked the following questions about the email: (1) "On which date did you receive this email?" (2) "Approximately how long was the email?" (3) "Did the email contain one or more emoji?" (1 = yes, 2 = no). (3b) "Which emoji was in the email?" (Open question). (4) "Think back to the moment you received this email. At that moment, how positive or negative did you think the feedback/response/answer was?" (1 = extremely negative, 9 = extremely positive). (In our pre-registration we accidentally said that we would use 7-point scales, but that would deviate from Study 1.)

In the Prolific sample, participants then answered the neuroticism subscale of the "Big Five Inventory" (John & Srivastava, 1999). The average neuroticism score was $M = 3.36$ ($SD = 1.12$) and the scale had a good reliability ($\alpha = .87$).

Next, we asked: "How long have you known the person who sent you the email? Please answer in months." The mean for this question was 27 months ($SD = 60.55$). We then asked: "What is the relative status of the person who sent you the email? 1 = This person has a higher status (e.g. you report to that person, it is your teacher) (selected by 48.5 %), 2 = This person has the same status (e.g. you are colleagues, it is a customer) (selected by 43.2 %), 3 = This person has a lower status (e.g. that person reports to you, it is a student) (selected by 5.5 %), 4 = Other, please specify (selected by 2.8 %).

We again asked the participant to generate an identification number to match the responses from the receiver and the sender. Finally, we

asked the participants to send the sender an invitation to a short survey so that the sender could give their consent and rate the valence of the message they sent.

The survey for the sender again consisted of five questions: (1) informed consent, (2) the identification number, (3) the valence rating: "Please look at (the screenshot of) the email that was included in the invitation to this survey. In that email you gave feedback or responded to something or gave an answer to a question. Think back to the moment you sent this email. At that moment, how positive or negative did you intend this message to be?" (1 = extremely negative, 9 = extremely positive), (4) gender (male, female, other, rather not say), and (5) age.

We again checked the screenshots, and all emails met the requirements. Given that the instructions included a broader set of possible emails, it seemed that everyone was able to find an email that contained an answer or feedback. For example, this email is an answer to a request (e.g. "Hi. Sure, will forward your request to HR department. You should expect a response soon. Cheers [Name].") and this email is about receiving feedback on something ("Thank you for sharing the output file. I've had a chance to review it - The structure looks great,").

6.2. Descriptive statistics

According to the answers of the receivers, the emails were on average 113 words long ($SD = 246$) and 7.8 % contained an emoji. The email was on average from 51 days ago ($SD = 177$), but this value was heavily influenced by a few outliers, the median was only 5 days. The average perceived valence was 6.62 ($SD = 1.66$). In the subsample of which we have both receiver and sender ratings ($n = 61$), the average perceived valence was 7.07 ($SD = 1.29$) and the average intended valence was 6.92 ($SD = 1.49$). Table 3 presents the correlations between our variables. Again, we see that receiver and sender valence ratings are significantly correlated ($r = .38, p = .003$).

6.2.1. Comparison between sender and perceiver valence ratings

We again first compared the intended valence with the perceived valence with a paired samples *t*-test. We found no significant difference between the valence as intended by the sender ($M = 6.92, SD = 1.49$) and the valence as perceived by the receiver ($M = 7.07, SD = 1.29$), $t(60) = .74, p = .46, d = .095$. There was no significant skewness or kurtosis in the distribution of the difference score, so the assumption of normality was met.

The equivalence test showed that, also in this study, we can rule out an effect in either direction that is larger than half a point (on our 9-point scale): TOST Lower = $t(60) = 1.77, p = .04$, TOST Upper = $t(60) = 3.25, p = .001$. Again, we can conclude that receivers are quite accurate in perceiving the valence of an email, which is in line with our hypothesis.

6.2.2. The role of age, gender, emoji, message length, neuroticism, closeness, and relative status

Next, we again tested whether the effect is moderated by first calculating the difference score between the intended and the perceived valence. Larger scores on this variable indicate an overly negative interpretation. We used this score as the outcome variable in a regression analysis with age and gender (only male and female) of the sender, emoji, how long the receiver knew the sender, and the relative status (only same versus the other has a higher status) as predictors. (It was not possible to include the length of the email and neuroticism in this model because we had only 28 data points with data on all these variables.) This model was not significant, $R^2 = .06, F(5, 51) = .65, p = .66$, indicating that neither age, nor gender, nor the presence of an emoji, nor the relative status of receiver and sender, nor how long the sender and receiver have known each other predicts whether a message is interpreted as overly positive or negative.

Table 3
Correlations between the key variables of Study 2.

	1	2	3	4	5	6	7	8	9
1) Age receiver									
2) Gender receiver (0 = female)	-.06								
	357								
3) Length relationship	.22***	-.12*							
	357	355							
4) Length email	-.06	.01	-.06						
	175	174	174						
5) Emoji (0 = no)	-.01	-.11*	.03	-.02					
	359	357	357	175					
6) Status (0 = same)	-.28***	.01	-.05	.12	-.10				
	331	327	327	155	329				
7) Neuroticism receiver	-.27**	-.14*	-.10	.02	.07	.22**			
	192	191	191	175	192	170			
8) Valence rating receiver	.03	.02	.02	-.03	.13*	.07	-.16*		
	359	357	357	175	359	329	192		
9) Valence rating sender	-.01	-.10	-.11	.15	.13	-.04	-.01	.38**	
	59	58	59	29	59	56	33	59	
10) Valence difference	-.08	.00	-.06	.05	.07	-.04	-.13	-.47**	.64***
	59	58	59	29	59	56	33	59	59

Note. The first number represents Pearson’s *r*, the second number represents the degrees of freedom. The valence difference is calculated as the rating of the sender minus the rating of the receiver. The levels of the categorical predictors are: gender receiver ((0 = female, 1 = male), Emoji (0 = absent, 1 = present), Status (0 = same, 1 = sender has higher status).

6.2.3. Perceived valence

Finally, we again performed a regression analysis with the perceived valence of the receiver as outcome variable to test which circumstances make the perception of a message more negative or positive in general. We first included the same predictors as above, which allowed us to include 321 responses. This regression model was not significant, $R^2 = .03$, $F(5, 321) = 2.11$, $p = .06$. We then ran another model with only the data from the Prolific sample, that allowed us to include the length of the email and the neuroticism of the receiver, to have a model that is more comparable to the model in Study 1. This regression model was also not significant, $R^2 = .05$, $F(6, 168) = 1.58$, $p = .15$. We thus do not replicate the finding from Study 1 that women rate the messages they received as more positive than men.

7. General discussion

It is often assumed, among scientists and laypeople alike, that people perceive online text-based messages differently and often more negatively than they are intended. The challenge with this claim is that it cannot be easily tested, as one needs to know from the sender how the message was intended and from the receiver how it was perceived. In the current paper, we collected data from both senders and receivers in two different settings and asked about actual messages exchanged between the two to have an externally valid test of the claim. We find no indication for (negative) misunderstanding in either text messages exchanged in an informal context or emails exchanged in a work or educational context. This indicates that people seem to be well able to correctly interpret the valence of text-based messages. The equivalence test in both studies showed that we can rule out a small effect (half a point on a 9-point scale) and we found no indication that the effect is associated with variables that have been proposed as influencing its strength (e.g. age, closeness, the use of emoji).

7.1. Theoretical implications

Our results make an important contribution to different theories about text-based communication. First, the results are in line with theoretical views that people can successfully use online communication to fulfill relational goals by adjusting their behavior to the restrictions posed by the medium (Walther, 1992). Earlier studies showed that people can successfully build up intimacy using online communication and our study shows that people can correctly identify the emotional

tone of the message they received. Apparently, the senders included the necessary information in their message to convey the right tone (Derks, Fischer, & Bos, 2008). Our finding challenges Media Richness Theory (Daft & Lengel, 1986) in showing that people are very well able to communicate messages through lean text-based media. That senders can successfully communicate their emotional state has earlier been shown in an experimental study where senders were instructed to act as if they were experiencing a positive or negative emotion while texting with a stranger (Hancock et al., 2007). The strangers in that study rated the ‘happy’ interaction partners as being in a more positive mood than the ‘sad’ interaction partners. Moreover, senders use more positive language if they formulate an email with a romantic message than if they formulate a voicemail with a romantic message (Wells & Dennis, 2016). Our results align with these findings by showing that the receiver can accurately interpret the valence that the sender wants to convey. Moreover, we extend these findings by showing that this also applies to real-life situations between non-strangers without explicit instructions to communicate accurately.

Second, our results challenge the idea that emotions cannot be communicated well via email, as proposed by Byron in 2008. Our studies show that people can correctly interpret the emotional tone of texts and emails. The idea was formulated almost two decades ago, so people may have adapted well to using lean media. It should be noted, however, that earlier studies indicated that some emails are interpreted very negatively by receivers, while they do not appear negative on the surface (Sillars & Zorn, 2021). So, it is still possible that misunderstandings will happen, but in the everyday messages we send and receive, the misalignment seems to be limited. Another finding by Sillars and Zorn (2021) was that messages from senders with a higher status are perceived as overly negative. We do not find that a higher status of the sender is related to lower valence ratings. The interplay between status and perceptions of a message may in fact be quite complex, as other research has found that if a message violates social norms (e.g. starting with ‘Hi’ without a name) senders with a lower status are perceived as more negatively than senders with a higher status (Axtell et al., 2020). Thus, more research is needed to fully understand the dynamics of email communication between people with a different status.

Third, our findings can also be related to the interpretation bias in online communication. That research showed that women are more likely to interpret ambiguous messages negatively than men, and that messages that are supposedly from female senders are interpreted more negatively by both genders (Kingsbury & Coplan, 2016). In our first

study we found that women rate the messages they receive more positive than men. This may seem like a contradiction, but we need to stress that research on the interpretation bias is performed with vignette studies with messages that are specifically designed to be ambiguous. Our first study concerned actual messages exchanged between friends. It may be that the messages females receive are more positive and/or are not ambiguous than messages that males receive. The overall intended valence was 7.39 on a 9-point scale in that study, so the friends' responses to the question about doing something together were very positive. The discrepancy between our findings and earlier findings using vignette methodology highlights the need to study communication with many different methods to get a complete picture. While research on the interpretation bias may leave the impression that females have a more negative experience when texting than men, our results show a different picture.

7.2. Limitations and future directions

Our results should be interpreted with the limitations of this study in mind. First, the current studies concern everyday text messages and emails. Our results showed that most of the messages were perceived and intended to be quite positive. Maybe if the topic of a message is more serious or concerns negative topics people are more likely to misinterpret it (Sillars & Zorn, 2021; Sussman & Sproull, 1999). Also, people who know each other might be less prone to (positive or negative) misunderstanding due to familiarity. Future research thus needs to establish the generalizability of the current findings to other situations and relationships.

Second, our study did not specifically focus on messages with an emotional character but on responses to a question or receiving feedback. One may therefore argue that there were no emotions to misunderstand in the messages. Still, the emotional character of the messages we studied was reflected in the fact that many reactions in our study involved an emoji to express a positive answer to the question and that the valence score was significantly different from the neutral midpoint of the scale in both studies, for both sender and receiver ratings.

Third, inherent to studying natural interactions, participants had to report their intentions and perceptions in hindsight. This might be less reliable than an assessment immediately upon sending and receiving a message. Experiments or studies using event sampling might be able to tackle this in future studies.

8. Conclusion

There is quite a strong idea that text-based communication is interpreted differently, and often more negatively, by the receiver than intended by the sender. This idea is also spread on popular websites, warning readers that text-based communication is 'a hotbed for miscommunication' (catch.com). But online communication may function better than its reputation. Our findings show that in various real-life contexts where people communicate with others that they know, the valence of a message is rarely misinterpreted. Moreover, this seems to hold for longer and shorter messages, messages that do or do not contain an emoji, messages from and to males and females, and messages from younger and older people. These findings align well with the idea that people can successfully design messages and adapt to lean types of media.

CRedit authorship contribution statement

Monique M.H. Pollmann: Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Carla A. Roos:** Writing – review & editing, Writing – original draft.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Supplement analysis

The analysis including the restricted sample of fully suitable screenshots also showed that there is no significant difference between the valence as intended by the sender and the valence as perceived by the receiver, $t(145) = 1.21, p = .23, d = .10$. The equivalence test showed that we can rule out an effect in either direction that is larger than half a point (on our 9-point scale): TOST Lower = $t(145) = 4.91, p < .001$, TOST Upper = $t(146) = 2.48, p = .007$.

Data availability

Data will be made available on request.

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