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Emojis as Social Information in Digital Communication

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Facial expressions of emotion are nonverbal cues that evoke affective, inferential, and social responses during face-to-face communication. Given that communication is moving more and more from face-to-face to digital contexts, the present research tested the functional equivalence of their digital counterparts—emojis. Eleven high-powered experiments tested the general effectiveness of emojis to convey emotionality and to disambiguate discourse during digital communication, as well as predictions about their social-emotional properties derived from the Emotion as Social Information (EASI) model. Compared to messages without emojis, those including emojis were perceived as emotionally more intense and as of more extreme valence. Furthermore, the effects of emojis on perceived valence were mediated via perceived emotional intensity. This suggests that emojis are effective quasi-nonverbal cues for digital communication. Furthermore, in line with predictions of the EASI model, emojis produced patterns similar to what has been observed for facial expressions of emotion in face-to-face communication, supporting their functional equivalence. Specifically, they instigated affective (emotion contagion) and inferential (understanding) processes, which subsequently resulted in behavioral intentions (empathic concern). In terms of the predicted mediating processes, we found differences between emojis and offline facial expressions of emotion. These deviations from our predictions are attributed to inherent differences between digital and face-to-face communication and limitations in the employed methodology. In light of the present findings, we discuss a theoretical synthesis of emojis in digital communication with the EASI model and propose a research agenda to connect emotion research with predominant forms of modern communication.

Keywords: emojis, facial expressions, digital communication, nonverbal communication, emotion

Communication is a key aspect of life, involving content that is both verbal and nonverbal (e.g., gestures or facial expressions). A hallmark of the postmillennial society is the rise of digital communication (Koch & Frees, 2016) and since the advent of multitouch smartphones in 2007; texting has supplanted phone or face-to-face conversations as the most popular method of communication (Smith et al., 2015). Although popular, text-based digital communication is limited in comparison with face-to-face communication (Kaye et al., 2017). For instance, whereas we can emphasize the emotional meaning of a sentence during face-to-face communication via nonverbal cues such as facial expressions or inflections of tone, this is not possible in text-based digital communication. As a partial remedy for this, emoticons, smileys, and emojis were developed. Emoticons are ASCII-based sign sequences modeling facial expressions like ":-)" or ":(," which are used to digitally refer to prototypical facial expressions. Nowadays, instant messaging apps also offer graphical interfaces for these emoticons, commonly referred to as smileys (i.e., graphical interfaces for facial expressions) or emojis (i.e., graphical interfaces for anything).[1]

Given that most communication happens digitally via text these days, it is not surprising that these digital aids have taken the world by storm. In 2015; the emoji U + 1F602 (a smiling face with tears of joy) was named the word of the year, recognizing the impact of emojis on language and popular culture. In 2017; a feature film dedicated entirely to emojis was released, earning over $200 million at the box office. Despite their meteoric rise in popular culture, surprisingly little research exists on potential psychological consequences of emoji usage

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All data and materials are available at https://osf.io/4y7nt/.

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[1] Although the term "emojis" encompasses many images beyond just faces, we will use it throughout this text rather than "smiley," because "smiley" is potentially confusing given that we did not only investigate smiles, but also other facial expressions of emotion.

in digital communication (for a recent discussion, see Kaye et al., 2017). Since emojis have become pervasive in text-based communication, what effects do they have on the meaning of the text they accompany and the interpersonal relationship between sender and receiver?

Qualitative studies suggest that people use emojis to communicate emotional tone, to reduce the ambiguity of discourse, and to lighten the mood (Derks et al., 2007, 2008; Kaye et al., 2016). Thus, emojis are said to serve as "quasi-nonverbal cues" employed to compensate for the lack of nonverbal channels in digital communication (Lo, 2008). However, empirical tests of these communicative functions are surprisingly scarce, especially given the prominent role emojis have in our daily lives. While a few studies have confirmed (Kaye & colleagues, 2016; Kaye & colleagues, 2017) qualitative reports, some of them had limited ecological validity, presenting chat protocols on paper rather than on an electronic device (e.g., Derks et al., 2007, 2008) or using uncommon and outdated graphical interfaces for emojis (e.g., Das et al., 2019; Manganari & Dimara, 2017). Finally, failed attempts at replication of some studies exist (Walther & D'Addario, 2001). More recent studies have proceeded to investigate the effects of emojis in more specific contexts such as online consumer behavior (see, e.g., Das et al., 2019; Lohmann et al., 2017; Manganari & Dimara, 2017) or workplace communication (Glikson et al., 2018). Although these studies overcame some of the previous limitations, they investigated situations in which emojis are not commonly used. In fact, Glikson and colleagues (2018) demonstrated that emojis are perceived as inappropriate in these contexts. The present research moves the field past these limitations in several ways to address two research goals.

First, we made appropriate changes to our stimulus design to reflect current digital communication technologies and we decided to locate our research within the context where emojis are actually used most commonly: instant messaging between friends. Thereby, we aimed to provide an updated test of how well emojis fulfill the nonverbal communicative functions that facial expressions of emotion have in face-to-face communication. These functions, as stated by Kaye and colleagues (2016) are 1) to set an emotional tone within a conversation, and 2) to reduce the ambiguity of discourse. Specifically, this means that emojis should lead to increased perceptions of emotionality in digital communication, and this emotionality should serve the purpose to clarify the central content of a message that is sent with an emoji. In the present studies, this content was always the perceived valence of a message, as most emojis were designed to emulate facial expressions of positive or negative emotions. We tested these communicative functions of emojis in Experiments 1a–1d.

Second, while many of the previous studies contributed to our understanding of individual social-emotional functions of emojis (e.g., emotion contagion; Lohmann et al., 2017); previous research has not done well to systematically integrate emojis into current theorizing in emotion research. Specifically, recent theorizing about the social nature of emotional expressions in face-to-face communication (Crivelli & Fridlund, 2018; Fridlund, 2014; Martin et al., 2017) provides a valuable template for this, with some approaches making direct reference to emojis as one form of such expressions (van Kleef, 2017).

These social-functional approaches to emotions (e.g., Frijda, 1986; Keltner & Haidt, 1999; Keltner et al., 2006) posit that facial expressions of emotion are not simply reflexive by-products of emotional states but rather can serve as social signals that influence interpersonal relationships (Reis & Collins, 2004). Since (digital) communication necessarily happens between at least two people, analyzing (virtual) facial expressions of emotion through the lens of social-functional approaches is an intuitive extension, which has even been proposed by some of these social-functional approaches (see van Kleef, 2017). Our second research goal was thus to provide additional empirical support for the functional equivalence of emojis and facial expressions of emotion from the perspective of the Emotions as Social Information (EASI) model (van Kleef, 2009). In Experiments 2a–4c we tested specific predictions based on this model, which we describe in the next section, and in doing so, we connect research on emojis from computer science, consumer behavior, and communication research with basic theorizing from emotion research.

The EASI Model

The EASI model posits that facial expressions of emotion influence observers by triggering one (or both) of two pathways, which subsequently affect behavior: inferential processes and affective reactions. Inferential processes are conclusions drawn based on facial expressions about the feelings and attitudes of the expresser. For instance, recent research suggests that smiles serve (among other functions) the purpose of creating and maintaining social bonds (Martin et al., 2017). Thus, when a social interaction partner smiles, a person might infer that the expresser is content with the way their social relation is going. This inference, in turn, will likely lead to the adoption of future behaviors that keep this relationship intact. Indeed, research has shown that affiliative displays of emotion such as smiling increase cooperation in individuals (Krumhuber et al., 2007) and even among groups (Barsade, 2002). Similarly, facial displays of anger can signal that past behaviors have not satisfied an interaction partner, leading to the inference that a person should change their behavior. In line with this, studies have also shown that negotiators make concessions when negotiation partners display anger, likely because they are afraid that otherwise the negotiations might reach an impasse (Sinaceur & Tiedens, 2006; van Kleef et al., 2004; van Kleef et al., 2015; van Dijk et al., 2008; Yip & Schweinsberg, 2017). Finally, similar research (also targeting a wider array of emotional facial expressions) has been conducted in the areas of leadership, organizational behavior, and social decision-making (for overviews on these topics, see Koning & van Kleef, 2015; van Kleef, 2014; van Kleef et al., 2010).

The second pathway within the EASI model states that facial expressions can influence observers by triggering affective reactions. Among other affective processes, van Kleef (2009) proposes that facial expressions can influence an observer's emotional state via the process of emotion contagion. That is, the same emotional state implied by the expresser's facial expression of emotion is correspondingly elicited in the observer (Hatfield et al., 1993). Extant research supports that vicariously experiencing an emotion can influence subsequent judgments and behaviors (Barsade, 2002; Barsade & Gibson, 2007). Again returning to the context of negotiations, prior studies suggest that displays of anger can also lead to the exclusion of an angry party from a coalition formation process (van Beest et al., 2008) and other retaliatory behaviors during negotiation (van Kleef & Côté, 2007).

Importantly, while the inferential and affective pathways are distinct, they should not be considered independent of one another. The above-mentioned discrepant results on the effects of anger during negotiations illustrate this: affective reactions (i.e., vicarious anger) can directly lead to retaliatory behaviors (e.g., van Beest et al., 2008). However, especially in situations where retaliation competes with other important outcomes, such as negotiations, affect might first and foremost serve as an input for further inferential processing. When considering that angry retaliation likely will stall or end the negotiation process, an individual might adopt different behavioral options while still feeling angry (e.g., van Dijk et al., 2008).

The EASI model proposes two moderators that describe which of the two pathways will have more sway: information processing and social-relational factors (van Kleef, 2009). First, information processing refers to the idea that inferential processes only happen when the observer of a facial expression has time and motivation to process the expression further. This is especially likely in situations of high importance—such as negotiations—and when there are no barriers to systematic processing such as time pressure or cognitive load. Second, social-relational factors such as norms can determine which affective reaction is elicited by a facial expression and which inferences are drawn based on the expression of emotion. Such factors (among others) include cultural norms about the appropriateness of emotional facial displays. By detailing two psychological processes (inferential processes and affective reactions) and two moderators that constrain activity of those processes, the EASI model provides a clear theoretical framework from which to derive testable hypotheses.

Finally, the EASI model not only makes predictions about emotional facial expressions in face-to-face communication. Rather, van Kleef (2017) states that:

> "EASI theory posits that expressions of the same emotion that are emitted via different expressive modalities (i.e., in the face, through the voice, by means of bodily postures, with words, or via symbols such as emoticons) have comparable effects, provided that the emotional expressions can be perceived by others" (p. 213).

While this functional equivalence tenet has been tested extensively for voices, bodily postures, and words (for a review, see van Kleef, 2017); support for the effect of emoticons or emojis through the lens of the EASI model so far has been relatively scarce (see our literature review above). Such investigations seem especially warranted given that there are reports suggesting that the last part of van Kleef's quote ("provided that the emotional expression can be perceived by others") might not always hold true for emojis (Miller et al., 2016). Thus, the second goal of the present studies was to test whether emojis fulfill the same social-emotional functions that the EASI model proposes and thereby their functional equivalence to emotional facial expressions of emotions in face-to-face communication.

Overview of the Present Research

As mentioned, the goal of the present research was twofold. First, we aimed to clarify whether or not emojis are able to set an emotional tone within digital communication and whether they are able to disambiguate the perceived valence of a message. These studies aimed to provide an updated assessment of their basic feasibility as nonverbal cues in digital communication. Second, after establishing their basic communicative properties, we aimed to test specific predictions from the EASI model (van Kleef, 2009) about the social-emotional functions of emojis. Specifically, we aimed to test whether they instigate affective and inferential processing, and thereby affect social and behavioral outcomes in the same way as facial expressions of emotions do in face-to-face communication.

To achieve both goals, the general experimental setup was the same across almost all experiments: participants were asked to read and rate several instant chat messages. Half of these messages conveyed positive valence while the remaining half conveyed negative valence. Orthogonally to this, half of all messages included an emotion-congruent facial expression emoji while the remaining messages did not.

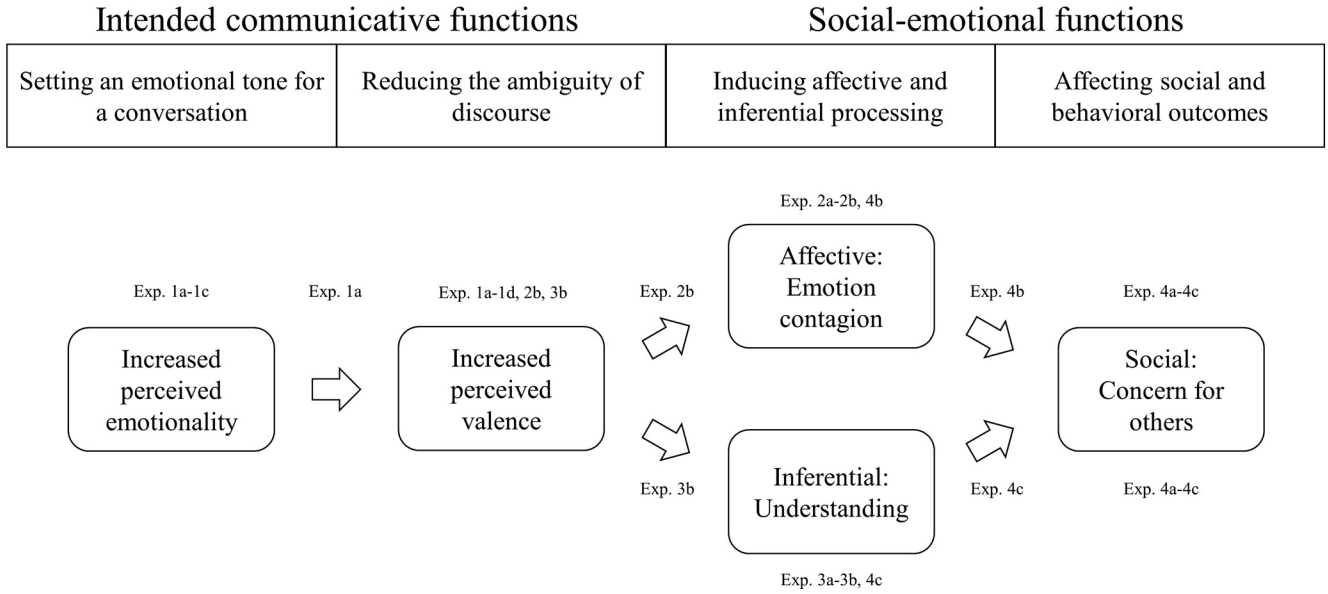
Concerning our first research goal, in Experiments 1a participants rated how emotionally intense they perceived these messages, and they indicated how positive or negative they found the messages (perceived message valence). Since emojis reincorporate at least one nonverbal channel to express emotions into digital communication, we predicted that they would increase a message's emotional tone or intensity. Furthermore, emotional intensity was predicted to be positively correlated with the perceived valence of a message. Therefore, we predicted that (a) emotion-congruent emojis increase the emotional intensity, and (b) accentuate the perceived valence of a text message, and c) their effect on perceived valence should be mediated via increased emotional intensity. These hypotheses correspond to a qualitative analysis of user reports about using emojis in digital communication (Kaye et al., 2016). Experiments 1b–1d were conducted to rule out alternative explanations for these findings and to test the role of demand within our general experimental setup.

Next, we moved on to test the equivalence of emojis in terms of the affective, inferential, and social consequences that the EASI model proposes. While the general experimental setup was the same as in Experiment 1a, the dependent variables in these studies were modified.

Concerning the affective pathway of the EASI model, we predicted that the presence of a (digital) facial expression of emotion in text messages induces emotion contagion in the recipient of the message. To assess this, in Experiments 2a–2b we asked participants to indicate how they themselves felt after reading text messages with and without emotion-congruent emojis. We expected that positive messages including an emoji would cause a stronger (i.e., more positive) affective reaction. Conversely, negative messages including an emoji were predicted to cause more negative affective reactions compared to plain negative text messages. Furthermore, we predicted that the strength of emotion contagion would be tied to the effect of emojis on perceived message valence: the more extreme the perceived valence of a message, the stronger the potential emotion contagion. Thus, we predicted that the effects of emojis on emotion contagion would be mediated via perceived message valence.

Similarly, we tested whether (digital) facial expressions of emotion lead to additional inferential processes in Experiments 3a–3b. As a testbed for inferential processing, we assessed the degree to which participants believed they understood the emotional state of the sender of an instant text-message. We predicted that emojis would enhance the level of understanding compared to plain text messages. Concerning the role of perceived message valence, we

Figure 1
Overview of the Present Research



Note. The top of the figure shows the intended communicative and social-emotional functions that are associated with including an emoji in a message. The flowchart below shows the variables we used to operationalize these functions, the proposed relations between those variables, and which experiments tested those variables or relations.

predicted that understanding would also be positively related to the effect of emojis on perceived message valence. The stronger the effect of an emoji on perceived message valence, the more successful the emoji was in setting an emotional tone. Consequently, inferential processes have a stronger source signal to build upon. Therefore, we again predicted that the effects of emotion-congruent emojis on understanding (as an indicator of inferential processes) would be mediated via perceived message valence.

Finally, Experiments 4a–4c took a first step toward testing the social functions that emojis serve in digital communication. Directly derived from the EASI model, we predicted that both inferential processes and affective reactions lead to interpersonal consequences. Specifically, we assessed participants' empathic concern ("other-oriented feelings of sympathy and concern"; Davis, 1983, p. 114) for the sender of a message. We decided to measure empathic concern rather than behavior for three reasons: First, behavioral options are usually severely limited in digital communication which questions the feasibility of assessing prosocial behavior or intentions in this situation. Second, empathic concern is reliably correlated with prosociality both in experimental (Batson, 2002) as well as survey research (Einolf, 2008), and therefore still provides an adequate test of the proposed conceptual relation to behavior. Third, given that the messages we selected for the current research were quite mundane in their content, participants might have rightly concluded that no behavior was necessary in response to these messages. Thus, we favored external validity over a one-to-one correspondence with the EASI model for tests of the social effects of emojis in digital communication.

In sum, the present research provides an updated assessment of how well emojis fulfill their intended role as nonverbal cues in digital communication and for the first time systematically tests their functional equivalence to facial expressions of emotion, which has been proposed by social-functional theories of emotions (van Kleef, 2009, 2017). Figure 1 summarizes the central constructs and their operationalization of all present studies.

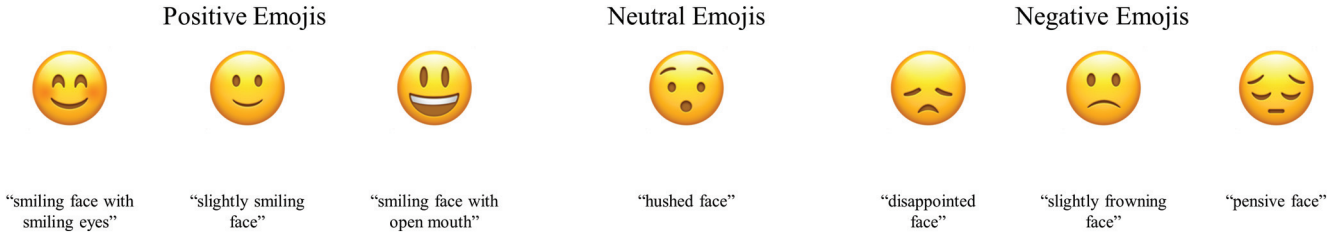
Power Analyses, Ethics, and Open Practices

All experiments aimed to be sufficiently sensitive to medium-sized effects ($\eta_p^2 = .06$) with a power of $(1-\beta) = .80$. The sample size needed for this in a 2×2 repeated-measures ANOVA is $N = 60$ (calculated in G*power; Faul et al., 2007). Experiment 1c was designed to mimic the number of datapoints in a between-subjects design and since all participants only rated $K = 1$ instead of $K = 100$ messages, the target was $N = 600$ participants. For Experiment 1d, we decided to double the sample size (target $N = 120$) because we anticipated smaller differences due to the design changes made (see below). Based on the effect sizes in Experiments 1a–1b (all η_p^2s $> .30$), we reduced the sample size to $N = 40$ for Experiment 2a. However, given the results of Experiment 2a we returned to $N = 60$ for the remainder of the studies. The studies received ethical approval at the respective institutions, if deemed necessary. We report all measures and manipulations. There were no exclusions in any experiment. All data and materials are available at https://osf.io/4y7nt/.

Experiments 1a–1d: Intended Communicative Functions of Smileys

The first four experiments tested whether facial expression emojis fulfill the communicative functions that users most commonly report intending to use them for: setting an emotional tone and reducing ambiguity (Kaye et al., 2016). In the present experiments we used emotional intensity as a proxy for the emotional tone of a message, and

Figure 2
Overview of All Emojis Used in the Present Research



Note. See the online article for the color version of this figure.

perceived message valence as an indicator for the central content that was to be clarified by emojis. While clearly related, it is important to point out the differences between emotional intensity and perceived valence, and how they are likely related.

he emotional tone of a message refers to its delivery, that is, how intensely a verbal communication act is conveyed. For example, in face-to-face communication the same verbal content can be conveyed in an indifferent inflection of tone or with a level of enthusiasm. As a common example in the English language, consider the statement "I'm fine." Although the valence of this message is the same irrespective of how it is presented (the speaker conveys that they are well, and thus something positive), the delivery affects its perceived valence. When spoken with indifference, it is usually perceived as the standard answer to the communicative ritual of starting a conversation by asking how someone else is doing and it is unlikely that the receiver will further process this statement. When spoken enthusiastically, however, the receiver likely will expect that something positive has happened to the sender of the message and thus perceive the valence of the message as more positive. Thus, higher emotional intensity correlates with stronger perceived valence and based on this we predicted that the effects of emojis on perceived valence would be mediated by increased emotional intensity—if emojis indeed are equivalent to nonverbal cues in face-to-face communication.

Experiment 1b–1c also tested the role of experimental demand for these effects. Experiment 1d tested the alternative explanation that smileys affect valence ratings directly.

Method

In all four experiments, participants were presented with WhatsApp messages and were instructed to imagine a friend/acquaintance had sent the messages. In Experiments 1a–1c half of these messages were positive (e.g., "I am happy") and half were negative (e.g., "I am sad"). In Experiment 1d there were also neutral messages (e.g., "That's possible") and the three valences (positive, negative, and neutral) were evenly split across trials. The following sections elaborate the crucial differences between these studies.

Experiment 1a

Participants saw a total of $K = 100$ messages. Randomly selected, half of the positive and half of the negative messages were presented with or without one of two emotion-congruent emojis (iOS sourced). The two positive emojis were the "slightly smiling face" (Unicode: U + 1F642; valence: $M = 5.80$; arousal: $M = 3.66$) and the "smiling face with smiling eyes" (Unicode: U + 1F60A; valence: $M = 6.29$; arousal: $M = 4.68$). The two negative emojis were the "slightly frowning face" (Unicode: U + 1F641; valence: $M = 2.35$; arousal: $M = 4.55$) and the "disappointed face" (Unicode: U + 1F61E; valence: $M = 2.13$; arousal: $M = 4.30$).[2] All stimuli of all experiments are available at https://osf.io/4y7nt/, and Figure 2 shows all emojis used in the present research.

Participants were asked to rate the emotional intensity of every message on a scale from 0 ("not emotional at all") to 10 ("very emotional"), and its valence on a scale from –5 ("very negative") to 5 ("very positive"). These two ratings were analyzed using a 2 (Message Valence: Negative vs. Positive) × 2 (Emoji present: Yes vs. No) repeated-measures ANOVA.

Experiment 1b

Since we adopted a within-subjects design, it was possible that participants gained insight into the crucial manipulation of the study and guessed that they were expected to alter their responses whenever an emoji was used. To investigate such potential effects, in Experiment 1b half of participants ($n = 68$) were told that the emojis were randomly added to the messages by the computer program, while the remaining participants ($n = 69$) were not given any information. Thus, in the randomly generated emoji condition participants had no reason to believe that the experimenter strategically placed the emojis in certain messages to evoke specific responses, and therefore comparing the results of this condition with the uninformed control condition allowed us to gauge the impact of experimenter expectations on the observed results. Otherwise, Experiment 1b was identical to Experiment 1a.

Data of Experiment 1b were analyzed using a 2 (Message Valence: Negative vs. Positive) × 2 (Emoji present: Yes vs. No) × 2 (Emoji Generation: Randomly Generated vs. Control [no information]; between) mixed ANOVA.

Experiment 1c

To most conclusively rule out demand effects, in this experiment every participant only rated one text message that was either positive or negative and sent with or without a smiley (the smileys used here were the "smiling face with smiling eyes" and the "disappointed face" emojis). Only one trial per participant was used because presenting participants with multiple messages that all were sent with or without an emoji, could have obscured their informational value. This would be akin to a person always using

[2] The normative ratings for the emojis were taken from Rodrigues and colleagues (2018).

the same inflection of tone during face-to-face communication, which erases any inherent meaning this tone might have had initially. Thus, Experiment 1c had the same 2 (Message Valence: Negative vs. Positive) × 2 (Emoji present: Yes vs. No) design as Experiment 1a, but instead of a within-subjects design, here a between-subjects design was implemented.

Experiment 1d

Experiment 1d served the purpose of ruling out an alternative explanation of the predicted results. While we so far assumed that emojis affect the perceived valence of a message via increased emotional intensity, alternatively smileys also could directly cause the previously observed outcomes. That is, smileys could be emblematic for valence and directly translate into valence judgments. This mechanism holds that their effects are not related to social information during communication at all, but rather perceptual in nature.

To address thus, Experiment 1d had a 3 (Message Valence: Negative vs. Neutral vs. Positive) x 3 (Emoji: Negative vs. Neutral vs. Positive) within-subjects design. Participants rated $K = 18$ positive, negative, or neutral messages. The messages' structure was kept as parallel, yet as distinct in valence as possible (e.g., positive version: "That's clever," neutral: "That's possible," negative: "That's stupid"). In this experiment, participants only rated the valence of the presented messages on a scale from 1 ("very negative") to 7 ("very positive").

$N = 46$ participants pilot tested the valence of the text messages for the main study on a scale from 1 (very negative) to 7 (very positive). Message triplets with the following average valences were selected for the main study: positive ($M = 5.79$, $SD = .88$), neutral ($M = 4.17$, $SD = .96$), and negative ($M = 2.45$, $SD = .97$).

Orthogonally to the messages' content, all messages were presented with a negative, neutral, or positive emoji. As the negative emoji, we chose the "Pensive Face" ($M = 2.4$, $SD = 1.26$, U + 1F614). For the neutral emoji, we presented the "Hushed Face" ($M = 4.00$, $SD = .84$, U + 1F62F). For the positive emoji, we used the "Smiling Face with Open Mouth" ($M = 5.78$, $SD = 1.26$, U + 1F60A; for ratings, see footnote 2). These smileys were selected to match the valence ratings of the message texts. The smileys were WhatsApp Version 2.19.352 sourced.

Based on the idea that smileys are nonverbal communication cues, we expected main effects of verbal (the message) and nonverbal (emojis) cues on perceived valence. Specifically, any message that is accompanied by a positive/negative emoji should be perceived as more valent in line with the emoji's valence. Importantly, if participants process the verbal content of the message as well, there should also be inherent differences between positive, neutral, and negative messages. If the effects of smileys were due to their mere perception, on the other hand, the emoji alone would determine their perceived valence. Granted, it seems implausible to assume that a negative message with a positive emoji would be perceived as positive, but the comparison between neutral and positive/negative messages with an emotion-congruent emoji provides a fair test of this alternative mechanism. Based on the idea that smileys directly affect valence judgments by virtue of their mere perception, (at least) neutral and positive/negative messages that include the same positive/negative emoji should be rated as equally positive/negative. To test this, we compared neutral and positive as well as neutral and negative text messages featuring positive/negative emojis with each other. In all experiments, participants provided demographic data at the end of the session.

Samples

In Experiment 1a, of $N = 59$ students ($n = 44$ female; age: $M = 27.59$, $SD = 10.24$) from the University of Würzburg participated in a 60-minute laboratory study involving another irrelevant task (Krishna & Eder, 2018). Experiment 1a took 15 minutes to complete. Participants received a compensation of 8 €.

In Experiment 1b, $N = 137$ students ($n = 103$ female; $n = 31$ male; $n = 3$ other; age: $M = 22.98$, $SD = 3.65$) from the University of Cologne participated in a 30-minute laboratory study involving other irrelevant tasks (Erle & Topolinski, 2018). Experiment 1b took 15 minutes to complete. Participants received compensation of 4 €.

Experiments 1c and 1d were conducted online on Prolific Academic. In Experiment 1c, $N = 607$ individuals ($n = 238$ female, $n = 366$ male, $n = 3$ diverse; age: $M = 27.43$, $SD = 9.79$) participated for a financial compensation of .25£.

In Experiment 1d, $N = 135$ individuals ($n = 56$ female, $n = 77$ male, $n = 2$ diverse; age: $M = 29.01$, $SD = 9.67$) participated for a financial compensation of .5£.

Results

All descriptive statistics for Experiments 1a–1d can be found in Tables 1–2.

Experiment 1a

For emotionality, there was only a significant main effect of Emoji, $F(1, 58) = 28.50$, $p < .001$, $\eta_p^2 = .33$. Messages including an emoji ($M = 4.66$; $SD = 1.73$) were rated as more emotionally intense than messages without emojis ($M = 3.68$; $SD = 1.85$). The effect size was medium to large, $d_z = .70$. The main effect of

Table 1
Descriptive Statistics in Experiments 1a–1c

		Positive messages		Negative messages	
Exp.	Dependent variable	No emoji	With emoji	No emoji	With emoji
1a	Valence	2.16 (0.86)	2.43 (0.91)	−2.38 (0.80)	−2.62 (0.74)
	Emotional intensity	3.68 (1.97)	4.76 (1.84)	3.69 (1.85)	4.57 (1.72)
1b	Valence	2.17 (1.07)	2.49 (1.08)	−2.51 (0.97)	−2.68 (0.97)
	Emotional intensity	3.22 (1.91)	4.29 (2.10)	3.32 (1.81)	4.46 (1.97)
1c	Valence	3.38 (1.93)	3.97 (1.28)	−2.47 (1.57)	−3.08 (1.52)
	Emotional intensity	4.81 (2.96)	5.60 (2.41)	5.52 (2.55)	5.88 (2.56)

Note. Table displays means (and standard deviations). Valence was measured on a scale from −5 to 5. Emotionality was measured on a scale from 0 to 10.

Table 2
Descriptive Statistics in Experiment 1d

Message type	*M*	*SD*
Positive message, Negative smiley	4.09	1.28
Positive message, Neutral smiley	5.51	0.94
Positive message, Positive smiley	6.24	0.77
Neutral message, Negative smiley	3.07	0.89
Neutral message, Neutral smiley	4.33	0.62
Neutral message, Positive smiley	5.44	0.90
Negative message, Negative smiley	2.00	0.78
Negative message, Neutral smiley	2.62	0.81
Negative message, Positive smiley	3.53	1.31

Notes. Valence was assessed on a scale from 1 to 7.

Message Valence and the interaction effect were nonsignificant, both Fs < 1.93, both ps $\geq .170$.

For valence, there was a significant main effect of Message Valence, $F(1, 58) = 622.27$, $p < .001$, $\eta_p^2 = .92$, indicating that positive messages were rated as more positive than negative messages. More importantly, there was a significant Emoji × Message Valence interaction. Positive messages with an emoji were perceived as more positive than positive messages without an emoji, $t(58) = 4.02$, $p < .001$, $d_z = .52$, and negative messages with an emoji were perceived as more negative than negative messages without an emoji, $t(58) = 5.13$, $p < .001$, $d_z = .67$. The main effect of Emoji was not significant, $F(1, 58) = .31$, $p = .579$.

Following the analyses on the mean level, a mediation analysis with Emoji (0 = No vs. 1 = Yes) as predictor, Emotional Intensity as mediator, and Perceived Valence as criterion was conducted using the PROCESS Macro for SPSS (model 4; Hayes, 2013). Since the same predictions was made for positive and negative messages, Message Valence was transformed to absolute values to map all valence ratings onto a scale from 0 (low valence) to 5 (high valence). Regression weights and 95% CIs were estimated using 5,000 bootstrap samples. The correlation between variables used for mediation analyses in all studies can be seen in Table 3.

The model explained a significant proportion of variance, $F(2, 233) = 16.48$, $p < .001$, $R^2 = .35$. There was a significant and positive indirect effect of Emojis on Message Valence via Emotional intensity, $B = .14$, 95% CI [.07, .25], $SE = .05$, which reduced the direct effect of Emojis on Message Valence to nonsignificance, $B = .11$, 95% CI [−.10, .32], $SE = .11$. Thus, the effect of emojis on valence was fully statistically mediated by message emotional intensity. We also tested the reverse mediation model with Message Valence as mediator and Emotional Intensity as criterion, but in this model there was an indirect effect, $B = .18$, 95% CI [.03, .40], $SE = .09$, that did not reduce the direct effect to nonsignificance, $B = .80$, 95% CI [.35, 1.25], $SE = .23$. Thus, the mediation analyses favor the theoretically predicted model.

Experiment 1b

For emotional intensity, the ANOVA yielded a main effect of Message Valence, $F(1, 135) = 4.43$, $p = .037$, $\eta_p^2 = .03$, indicating that negative messages were rated as more emotionally intense than positive messages. More importantly, there was a main effect of Emoji, $F(1, 135) = 100.32$, $p < .001$, $\eta_p^2 = .43$. Messages with emojis ($M = 4.37$; $SD = 1.98$) were more emotionally intense than messages with no emoji ($M = 3.27$; $SD = 1.80$). The effect size was large, $d_z = .86$. All other effects were not significant, all Fs $<$ 2.79, all ps $\geq .097$.

For valence, there were main effects of Emoji, $F(1, 135) = 6.45$, $p = .012$, $\eta_p^2 = .05$, indicating that ratings were more positive after messages including emojis, and Message valence, $F(1, 135) = 900.08$, $p < .001$, $\eta_p^2 = .87$, indicating that positive messages were perceived as more positive than negative messages. More importantly and qualifying these main effects, the predicted Emoji × Message Valence interaction was significant, $F(1, 135) = 60.76$, $p < .001$, $\eta_p^2 = .31$. Messages including and emoji were rated as more positive/negative than messages without an emoji. This was true for both the Control (no information) condition, $t(68) = 5.94$, $p < .001$, $d_z = .72$ for positive messages, $t(68) = 2.78$, $p = .007$, $d_z = .33$ for negative messages, and the Randomly Generated Emoji condition, $t(67) = 3.66$, $p < .001$, $d_z = .44$ for positive messages, $t(67) = 4.16$, $p < .001$, $d_z = .50$ for negative messages.

Importantly, for both dependent variables there was no significant effect involving Emoji Generation, all Fs < 2.79, all ps $\geq .097$. For both Emotional Intensity and Valence, we computed a 2 (Emoji Generation: Randomly Generated vs. Control [no information]; between) × 2 (Message Valence: Negative vs. Positive) x 2 (Emoji present: Yes vs. No) mixed Bayesian ANOVA to quantify the evidence for the absence of an effect of Emoji Generation. Bayes Factors for the inclusion of the main effect of Emoji Generation and interactions including this factor were derived, which quantify the extent to which the data support their inclusion. These Bayes Factors all spoke against the inclusion of the Emoji Generation variable, all $BF_{01} >$ 11.23, range: 11.24–250.00. Bayes factors of this magnitude are conventionally described as "strong" to "very strong" evidence against the inclusion of these effects (Jeffreys, 1961; p. 432).

Experiment 1c

For Emotionality, the ANOVA yielded main effects of Message Valence, $F(1, 599) = 5.42$, $p = .020$, $\eta_p^2 = .01$ (indicating that negative

Table 3
Correlations Between Variables for All Reported Mediation Analyses

	Experiment					
Correlation tested	Exp. 1a	Exp. 1b	Exp. 2b	Exp. 3b	Exp. 4b	Exp. 4c
Emotional intensity—Perceived valence	.35	.50	—	—	—	—
Perceived valence—Emotion contagion	—	—	.68	—	—	—
Perceived valence—Understanding	—	—	—	.37	—	—
Emotion contagion—Empathic concern	—	—	—	—	.34	—
Understanding—Empathic concern	—	—	—	—	—	.51

Note. All correlations are significant at the $p < .001$ level.

messages were perceived as slightly more emotionally intense than positive messages), and Emoji, $F(1, 599) = 7.21$, $p = .007$, $\eta_p^2 = .01$. Messages including an emoji ($M = 5.73$; $SD = 2.78$) were rated as more emotionally intense than messages without emojis ($M = 5.17$; $SD = 2.48$). The interaction between the two independent variables was not significant, $F(1, 599) = 1.03$, $p = .311$.

For Valence, the ANOVA yielded main effects of Message Valence, $F(1, 599) = 2482.65$, $p < .001$, $\eta_p^2 = .81$ (indicating that negative messages were perceived as more negative than positive messages), and a significant Message Valence x Emoji interaction, $F(1, 599) = 21.77$, $p < .001$, $\eta_p^2 = .04$. Positive messages with an emoji were perceived as more positive than positive messages without an emoji, $t(303) = 3.17$, $p = .002$, $d = .36$, and negative messages with an emoji were perceived as more negative than negative messages without an emoji, $t(296) = 3.44$, $p = .001$, $d = .40$. The main effect of Emoji was not significant, $F(1, 599) = .01$, $p = .929$. The main effect of Emoji was not significant, $F(1, 599) = 1.03$, $p = .311$.

The effect sizes in this experiment, however, were only small to medium (emotionality: $d = .21$, valence positive messages: $d = .36$, valence negative messages: $d = .40$), indicating that experimental demand might have affected the previous results, although it cannot fully account for the observed differences.

Experiment 1d

Speaking against the alternative explanation of our previous data, the ANOVA yielded significant main effects of Message Valence, $F(2, 133) = 317.00$, $p < .001$, $\eta_p^2 = .83$, Emoji, $F(2, 133) = 215.02$, $p < .001$, $\eta_p^2 = .76$, and a significant interaction between these factors, $F(4, 131) = 16.82$, $p < .001$, $\eta_p^2 = .34$.

Planned comparisons revealed that both verbal (text) and nonverbal (emojis) cues affected valence ratings. Speaking against the idea that smileys directly translate into valence judgments irrespective of the message content, positive messages with positive smileys ($M = 6.24$, $SD = .77$) were perceived as more positive than neutral messages with positive smileys ($M = 5.51$, $SD = .94$), $t(134) = 11.42$, $p < .001$, $d_z = .87$. Similarly, negative messages with negative smileys ($M = 2.00$, $SD = .78$) were perceived as more positive than neutral messages with negative smileys ($M = 3.07$, $SD = .89$), $t(134) = 12.46$, $p < .001$, $d_z = 1.08$.

Discussion of Experiments 1a–1d: Intended Communicative Functions of Smileys

The results of the first experiments largely suggest that emojis produce effects that are functionally equivalent to effects observed for facial expressions of emotion in face-to-face communication. Experiments 1a–1c demonstrated that they increase the perceived emotional intensity of a message and all four experiments showed that they also accentuate the perceived valence of a message and thus its central content. In Experiment 1a, we also found evidence that their effects on valence are mediated via emotional intensity, and results spoke against the inverse mediation path (their effects on emotional intensity are mediated via perceived valence). Experiments 1b–1c ruled out that these findings are due to expectations about the experimenter's research goal (Exp. 1b) or other demand effects (Exp. 1c), although effect sizes were reduced when using a between-subjects design (Exp. 1c). Finally, Experiment 1d suggests that smileys do not affect valence judgments directly by perceptual means and demonstrated that participants pay attention both to the verbal and nonverbal contents of the messages in our experiments. However, as noted by an anonymous reviewer, while this study provides evidence that participants clearly process both the verbal and nonverbal valence cues in our messages, it does not provide direct support for the idea that emojis accentuate the meaning of a text and leaves open the possibility that other mechanisms produced the observed pattern of results. Such evidence could be provided only by studies comparing valence ratings of emojis to valence ratings of emojis in text messages. However, such comparisons are problematic themselves as an emoji alone does not represent a communicative act, and the mechanisms involved in evaluating communication differ from those employed to evaluate a picture alone.

Finally, an unexpected finding in most of these studies was that the impact of emojis on our dependent measures was stronger effects for positive than for negative text messages. Since this pattern persisted also in the later studies of the article, we will return to it in the general discussion. Therefore, irrespective of the exact mechanism assumed and this asymmetry in valence, the first conclusion that is still supported by our data is that emojis are effective at what they were designed to do: they reintroduce emotional intensity into digital communication: if one seeks to emphasize the emotional content of one's messages, emojis are a viable tool—both for positive and negative emotions.

Experiments 2a-2b: Affective Reactions

Experiments 2a–2b focused on the first pathway of the EASI model and specifically tested the effects of emojis on emotion contagion (Hatfield et al., 1993). We predicted that since emojis signal more emotional intensity and thereby accentuate the valence of a message, they increase the chance of evoking a congruent emotional response in the recipient. Thus, emojis were predicted to increase emotion contagion (i.e., they lead to more negative feelings in the participant after negative messages and to more positive feelings after positive messages). This effect was tested in both Experiments 2a and 2b. Furthermore, we predicted this effect to be mediated by increased perceived message valence, which we tested in Experiment 2b.

Method

Experiments 2a–2b were identical to Experiment 1a, but instead of rating emotional intensity and valence, in Experiment 2a participants rated how they felt themselves after reading the message on a scale from −5 ("very negative") to 5 ("very positive") as a measure of emotion contagion. In addition to participants' ratings of their own emotional states, message valence was assessed in Experiment 2b as in Experiments 1a-1c. *M* ratings on these variables were analyzed using a 2 (Valence Rating: Negative vs. Positive) × 2 (Emoji presence: Yes vs. No) repeated-measures ANOVA. In both experiments, participants provided demographic data at the end of the session.

Samples

Students from the University of Würzburg (Experiment 2a, $N = 40$, 23 female; age: $M = 22.15$, $SD = 3.24$; Experiment 2b, $N = 61$, 29 female; age: $M = 24.25$, $SD = 3.42$) participated in a 10-minute experiment in exchange for a candy bar.

Results

All descriptive statistics of Experiments 2a-4c are displayed in Table 4.

Emotion Contagion

In both Experiments, there were main effects of Message Valence, both Fs > 294.15, both ps $< .001$, both η_p^2s $> .87$, indicating that participants felt more positive after positive messages compared to negative messages. There was also a main effect of Emoji in both experiments, both Fs > 15.98, both ps $< .001$, both η_p^2s $> .23$, indicating that valence ratings were more positive after messages with emojis than without. More importantly and qualifying these main effects, both in Experiment 2a, $F(1, 39) = 15.82$, $p < .001$, $\eta_p^2 = .29$, and Experiment 2b, $F(1, 60) = 27.33$, $p < .001$, $\eta_p^2 = .31$, the predicted Emoji x Message Valence interaction was significant. In Experiment 2a, positive messages with an emoji elicited more emotion contagion than messages without an emoji, $t(39) = 5.11$, $p < .001$, $d_z = .81$, and unexpectedly negative messages with an emoji did not, $t(39) = 1.05$, $p = .298$, $d_z = .17$. In Experiment 2b both comparisons were significant, positive messages: $t(60) = 5.74$, $p < .001$, $d_z = .74$, negative messages: $t(60) = 3.10$, $p = .003$, $d_z = .40$.

Valence

Experiment 2b replicated the findings of Experiments 1a-1b with significant main effects of Message Valence, $F(1, 60) = 985.31$, $p < .001$, $\eta_p^2 = .94$, and Emoji, $F(1, 60) = 16.31$, $p < .001$, $\eta_p^2 = .21$ (see Experiments 1a-1c). More importantly and qualifying these main effects, the predicted Emoji x Message Valence interaction was significant, $F(1, 60) = 32.15$, $p < .001$, $\eta_p^2 = .35$. Positive messages with an emoji were perceived as more positive than positive messages without an emoji, $t(60) = 6.20$, $p < .001$, $d_z = .79$, and negative messages with an emoji were perceived as more negative than negative messages without an emoji, $t(60) = 3.32$, $p = .001$, $d_z = .43$.

Mediation

For Experiment 2b, a mediation analysis with Emoji (0 = No vs. 1 = Yes) as predictor, Message Valence as mediator, and Emotion Contagion as criterion was conducted as in Experiment 1a (model 4; Hayes, 2013).

The model explained a significant proportion of variance, $F(2, 241) = 104.87$, $p < .001$, $R^2 = .47$. There was an indirect effect of Emojis on Emotion contagion via Message Valence, $B = .28$, 95% CI [.15, .43], $SE = .07$, which reduced the direct effect of Emoji on Emotion contagion to nonsignificance, $B = .09$, 95% CI [−.06, .24], $SE = .08$. Thus, the effect of emojis on emotion contagion was fully mediated by increased perceived valence. Within the reverse mediation model there was again an indirect effect, $B = .24$, 95% CI [.12, .39], $SE = .07$, that did not reduce the direct effect to nonsignificance, $B = .18$, 95% CI [.04, .33], $SE = .07$, thus favoring the theoretically predicted model.

Experiments 3a-3b: Inferential Processing

Experiments 3a-3b went on to test the second pathway proposed in the EASI model (van Kleef, 2009). In analogy to facial expressions of emotion in face-to-face communication, we predicted that because emojis represent a nonverbal cue that disambiguates the emotional state of a person, they can instigate inferential processes about the emotional state of that person. Given that we used only clearly valent messages, emotion-congruent emojis, and that we standardized the relational schema between participants and the senders, we predicted that these inferences would be straightforward. Thus, we predicted that emojis would enhance the degree to which participants think they understand the sender's emotional state. In Experiment 3b we additionally assessed perceived message valence and we predicted that the effect of emojis on understanding would be mediated by enhanced message valence, because the stronger an emotional expression, the more likely it is that it will be perceived by another person and the higher the likelihood that this person then will engage in further inferential processing.

Method

The general setup for Experiments 3a-3b was again similar as in the previous studies. However, in Experiment 3a participants rated how well they understood sender's emotional state when writing the

Table 4
Descriptive Statistics in Experiments 2a−4c

		Positive messages		Negative messages	
Exp.	Dependent variable	No emoji	With emoji	No emoji	With emoji
2a	Emotional contagion	−1.81 (0.77)	−1.89 (0.82)	1.61 (0.74)	2.10 (0.76)
2b	Valence	2.23 (0.80)	2.83 (0.82)	−2.32 (0.10)	−2.57 (0.65)
	Emotional contagion	1.33 (0.75)	1.87 (0.88)	−1.36 (0.65)	−1.57 (0.71)
3a	Understanding	1.09 (1.82)	3.03 (0.85)	0.05 (1.98)	1.06 (2.71)
3b	Valence	2.33 (0.91)	3.02 (0.91)	−2.61 (0.68)	−2.81 (0.76)
	Understanding	5.92 (1.54)	7.19 (0.91)	4.94 (1.89)	5.57 (2.13)
4a	Empathic concern	1.09 (1.12)	1.90 (1.18)	0.18 (1.34)	0.33 (1.81)
4b	Emotional contagion	1.10 (0.85)	1.59 (0.94)	−1.11 (0.99)	−1.30 (1.31)
	Empathic concern	1.56 (1.75)	2.06 (2.01)	1.18 (1.32)	1.66 (1.76)
4c	Understanding	6.66 (1.38)	7.58 (1.12)	4.93 (2.16)	5.60 (2.64)
	Empathic concern	1.04 (0.94)	1.70 (0.98)	0.91 (1.17)	1.39 (1.50)

Note. Table displays means (and standard deviations). Emotional Contagion measured on a scale from −5 to 5. Understanding was measured on a scale from 0 to 10, except in Experiment 3a (scale from −5 to 5).

message on a scale from −5 ("very badly") to 5 ("very well") as a (subjective) measure of inferential processing (the scale ranged from 0 to 10 as in the other studies using this variable). In Experiment 3b, they additionally rated the messages' valence as in Experiments 1a-1c and 2b. *M* ratings on these dependent variables were analyzed using a 2 (Message Valence: Negative vs. Positive) x 2 (Emoji: Yes vs. No) repeated-measures ANOVA. After participants rated all messages, demographic data were assessed.

Samples

In Experiment 3a, $N = 59$ students ($n = 39$ female, $n = 19$ male, $n = 1$ missing; age: $M = 22.19$, $SD = 3.96$) from the University of Würzburg participated in a 10-minute experiment in exchange for a candy bar.

In Experiment 3b, $N = 60$ students ($n = 33$ female; age: $M = 22.27$, $SD = 3.00$) from the University of Würzburg participated in a 15-minute experiment in exchange for a candy bar.

Results

All descriptive statistics of Experiments 2a-4c are displayed in Table 4.

Understanding

In both Experiments, there were unexpected main effects of Message Valence, both Fs > 21.86, both ps $< .001$, both η_p^2s $\geq .27$, indicating that participants understood the sender's emotional state better for positive compared to negative messages. As predicted, in both experiments there was also a main effect of Emoji, both Fs > 36.47, both ps $< .001$, both η_p^2s $> .38$, indicating that emojis increased understanding. Unexpectedly and qualifying these main effects, both in Experiment 3a, $F(1, 58) = 14.89$, $p < .001$, $\eta_p^2 = .20$, and Experiment 3b, $F(1, 59) = 16.28$, $p < .001$, $\eta_p^2 = .22$, there was an Emoji x Message Valence interaction. Although emojis increased understanding for both positive and negative of messages, Experiment 3a: Positive messages: $t(58) = 8.75$, $p < .001$, $d_z = 1.14$, negative messages: $t(58) = 4.37$, $p < .001$, $d_z = .57$, Experiment 3b:, Positive messages: $t(59) = 6.41$, $p < .001$, $d_z = .83$, negative messages: $t(59) = 4.22$, $p < .001$, $d_z = .54$, this effect was larger for positive messages.

Valence

Experiment 3b replicated the findings of Experiments 1a-1b and 2b with significant irrelevant main effects of Message Valence, $F(1, 59) = 923.69$, $p < .001$, $\eta_p^2 = .94$, and Emoji, $F(1, 59) = 22.90$, $p < .001$, $\eta_p^2 = .28$. More importantly and qualifying these main effects, the predicted Emoji × Message Valence interaction was significant, $F(1, 59) = 31.65$, $p < .001$, $\eta_p^2 = .35$. Positive messages with an emoji were perceived as more positive than those without an emoji, $t(59) = 6.21$, $p < .001$, $d_z = .80$, and negative messages with an emoji were perceived as more negative than those without an emoji, $t(59) = 2.75$, $p = .008$, $d_z = .36$.

Mediation

For Experiment 3b, a mediation analysis with Emoji (0 = No vs. 1 = Yes) as predictor, Message Valence as mediator, and Understanding as criterion was conducted as in previous experiments (model 4; Hayes, 2013).

The model explained a significant proportion of variance, $F(2, 237) = 23.22$, $p < .001$, $R^2 = .16$. There was an indirect effect of Emoji on Understanding via Message Valence, $B = .31$, 95% CI [.15, .52], $SE = .09$. This indirect effect did not reduce the direct effect of Emojis on Understanding to nonsignificance, $B = .64$, 95% CI [.19, 1.09], $SE = .23$. Thus, the effect of emojis on understanding was partially mediated by perceived message valence. The reverse mediation model this time suggested an equally strong partial mediation with a significant indirect effect, $B = .14$, 95% CI [.07, .24], $SE = .04$, that did not reduce the direct effect to nonsignificance, $B = .30$, 95% CI [.10, .51], $SE = .10$. Therefore, the mediation analyses favored neither the theoretically predicted nor the reverse mediation model.

Experiments 4a–4c: Behavioral Intentions

Experiments 4a-4c investigated the effects of emojis on empathic concern, a social affective reaction that reliably correlates with behavior and behavioral intentions following emotional experiences (see Batson, 2002; Einolf, 2008). We predicted that compared to messages without an emoji, emojis would lead to higher empathic concern toward the sender of a message. Furthermore, in line with the EASI model (van Kleef, 2009) this effect was expected to be mediated by affective reactions (emotion contagion) and inferential processes (understanding). In Experiment 4b, we thus concurrently assessed emotion contagion and predicted that emojis would lead to greater empathic concern via emotion contagion: As participants experience the sender's emotions more strongly, they develop more empathic concern (i.e., vicarious joy for positive messages and compassion for negative messages). In Experiment 4c, we predicted the same mediation for understanding: As participants better understand the sender's emotional state, more empathic concern develops.

Method

In Experiment 4a participants were asked what their feelings toward the sender of the message were on a scale from −5 ("very cold feelings") to 5 ("very warm feelings") as a measure of empathic concern (see, e.g., Batson et al., 1997). In Experiment 4b, also emotion contagion was assessed as in Experiments 2a–2b, and in Experiment 4c, also their understanding was assessed as in Experiments 3a-3b. *M* ratings on these variables were analyzed using a 2 (Message Valence: Negative vs. Positive) × 2 (Emoji: Yes vs. No) repeated-measures ANOVA. After participants rated all messages, demographic data were assessed.

Samples

In Experiment 4a, $N = 61$ students ($n = 39$ female; age: $M = 21.43$, $SD = 2.99$) from the University of Würzburg participated in a 10-minute experiment for a candy bar.

In Experiment 4b, $N = 54$ students ($n = 41$ female, $n = 12$ male, $n = 1$ other; age: $M = 23.04$, $SD = 6.60$) from the University of Cologne participated in a 15-minute experiment in exchange for a candy bar.

In Experiment 4c, $N = 63$ students ($n = 46$ female, $n = 13$ male, $n = 1$ other, $n = 3$ missing; age: $M = 22.28$, $SD = 2.79$) from the University of Cologne participated in a 15-minute experiment in exchange for a candy bar.

Results

All descriptive statistics of Experiments 2a–4c are displayed in Table 4.

Empathic Concern

In Experiments 4a-4b, both Fs > 4.85, both ps $\leq .032$, both η_p^2s $> .08$, but not Experiment 4c, $F(1, 62) = 2.52$, $p = .117$, there was a main effect of Message Valence. Participants reported more of empathic concern after positive messages. Finally, in Experiment 4a there was a significant Message Valence × Emoji interaction, $F(1, 60) = 11.11$, $p = .001$, $\eta_p^2 = .16$ (Experiments 4b-4c: Both Fs < 3.17, both ps $\geq .080$), indicating that the increase of empathic concern for messages sent with an emoji was larger for positive messages.

More importantly and as predicted, in all experiments there was a significant main effect of Emoji, all Fs > 25.39, all ps $< .001$, all η_p^2s $> .29$. In Experiments 4a–4c, positive messages including an emoji evoked more empathic concern in the recipient than those without an emoji, all ts > 4.91, all ps $< .001$, all d_zs $> .66$. For negative messages, emojis significantly enhanced empathic concern only in Experiments 4b-4c, both ts > 4.64, both ps $< .001$, both d_zs $> .59$, whereas this difference was in the same direction, but nonsignificant in Experiment 4a, $t(60) = 1.13$, $p = .261$.

Emotion Contagion

In Experiment 4b, there were again main effects of Message Valence, $F(1, 53) = 122.99$, $p < .001$, $\eta_p^2 = .70$, and Emoji, $F(1, 53) = 4.58$, $p = .037$, $\eta_p^2 = .08$ (see Experiments 2a-2b). More importantly and qualifying these main effects, the predicted Emoji x Message Valence interaction was significant, $F(1, 53) = 35.46$, $p < .001$, $\eta_p^2 = .40$. Both positive, $t(53) = 5.05$, $p < .001$, $d_z = .69$, and negative messages including an emoji, $t(53) = 2.42$, $p = .019$, $d_z = .33$, elicited more emotion contagion than messages without an emoji.

Understanding

In Experiment 4c, there was a main effect of Message Valence, $F(1, 62) = 38.51$, $p < .001$, $\eta_p^2 = .39$, and a Message Valence × Emoji interaction, $F(1, 62) = 4.13$, $p = .046$, $\eta_p^2 = .06$ (see Experiments 3a–3b). Finally and most importantly, as predicted there was a main effect of Emoji, $F(1, 62) = 32.27$, $p < .001$ $\eta_p^2 = .34$, indicating that understanding of the sender was higher after messages including emojis. This was true for positive, $t(62) = 6.12$, $p < .001$, $d_z = .77$, and negative messages, $t(62) = 4.31$, $p < .001$, $d_z = .54$.

Mediations

For Experiments 4b-4c, mediation analyses with Emoji (0 = No vs. 1 = Yes) as predictor, Emotion contagion/Understanding as mediators, and Empathic Concern as criterion were done as in previous experiments (model 4; Hayes, 2013).

The model for Experiment 4b explained a significant proportion of variance, $F(2, 213) = 11.23$, $p = .001$, $R^2 = .22$. There was an indirect effect of Emoji on Empathic Concern via Emotion contagion, $B = .25$, 95% CI [.10, .46], $SE = .09$. This indirect effect reduced the direct effect of Emoji on Empathic Concern to nonsignificance, $B = .24$, 95% CI [−.20, .68], $SE = .22$. Thus, the effect of emojis on empathic concern was fully mediated by emotion contagion. The reverse mediation model again indicated a partial mediation pattern with an indirect effect, $B = .08$, 95% CI [.01, .16], $SE = .04$, that did not reduce the direct effect to nonsignificance, $B = .30$, 95% CI [.09, .51], $SE = .11$. Thus, the mediation analysis favored the theoretically predicted model.

The model for Experiment 4c also explained a significant proportion of variance, $F(2, 249) = 50.71$, $p < .001$, $R^2 = .29$. There was an indirect effect of Emoji on Empathic Concern via Understanding, $B = .17$, 95% CI [.06, .31], $SE = .06$. This indirect effect did not reduce the direct effect of Emoji on Empathic Concern to nonsignificance, $B = .36$, 95% CI [.15, .57], $SE = .11$. Thus, the effect of emojis on empathic concern was partially mediated by understanding. The reverse mediation test with Empathic Concern as mediator and Understanding as criterion surprisingly indicated a full mediation with an indirect effect, $B = .58$, 95% CI [.33, .89], $SE = .14$, that reduced the direct effect to nonsignificance, $B = .22$, 95% CI [−.26, .70], $SE = .25$. Therefore, in this case the mediation analyses favored the reverse mediation model over the theoretically predicted one.

Discussion of Experiments 2a–4c: Social-Emotional Functions of Smileys

Our second goal was to test whether emoji affect the two pathways of the EASI model in similar ways as facial expressions of emotion in face-to-face communication or put differently: their functional equivalence to facial expressions (van Kleef, 2017). On the mean level, all our predictions were confirmed: across seven experiments, emojis enhanced emotion contagion as an indicator of the affective pathway, they enhanced understanding as an indicator of the inferential pathway, and they also increased empathic concern as an indicator of behavioral intentions resulting from affective and inferential processes. Thus, on the mean level emojis were functionally equivalent to real facial expressions of emotion.

In terms of procedural characteristics, however, we could only partially confirm the proposed archetype of the EASI model. In terms of the affective pathway, our results perfectly mirror the EASI model: emojis increase emotion contagion (Exps. 2a-2b & 4b), and mediation analyses suggested that this fully explains their effect on empathic concern (Exp. 4b). One slight caveat about these relations is that we did not assess actual behavior, but rather a variable that is closely related to behavior (Batson, 2002; Einolf, 2008). Another limitation that relates to the findings for the affective pathway of the EASI model is the hypothetical nature of our studies. Since we only asked participants to imagine receiving these messages from friends, it is possible that instead of actual emotion contagion, participants merely reported their expected emotion contagion in this situation.

In terms of the inferential pathway, our results were mixed and mostly did not mirror what we predicted based on the EASI model. First, although emojis increased understanding (Exp. 3a–3b & 4c), this effect was not mediated via their effects on perceived valence (Exp. 3b). Mediation analyses rather suggested a bidirectional link between understanding and perceived valence. Emojis directly affected both variables, and indirectly affected them, mediated via the respective other. Rather than mediators and criteria, these two variables should therefore be considered correlates of each other. Finally, we predicted that the effects of emojis

on empathic concern would be mediated via understanding. Our results, however, more strongly supported the opposite conclusion, that is, emojis affect understanding via empathic concern (Exp. 4c).

As it relates to the bidirectional link between perceived valence and understanding, it is important to note that the EASI model focusses on the social–cognitive consequences of discrete expressions of emotions on observers' affective, inferential, and behavioral reactions. The present research, however, more globally investigated the effects of positive and negative perceived valence of emojis. Thus, while our findings did not confirm our prediction that the perceived valence of an emoji translates into inferential processing, future research is needed to test this prediction for emojis that convey specific discrete emotions. However, it should be noted that as of now there is only a clear understanding of how positively or negatively different emojis are perceived (Rodrigues et al., 2018); but it is currently unknown how well people classify emojis as depictions of discrete emotions, and some research suggests that they are notoriously hard to understand (Miller et al., 2016).

Upon reflection, also the uncertainties about the relation between understanding and empathic concern could be rooted in our methodology. While the EASI model would predict that inferential processing affects behavioral intentions and reactions, our mediation analyses rather point to the opposite. This discrepant finding might be due to the measure we used to assess inferential processing. First, compared to emotion contagion, which can be solely based on introspection, to which participants have full access, self-reports about the intentions of others and emotional understanding are comparatively unreliable as they involve inferences, which can be biased, for example, by egocentric projections (see Epley et al., 2004). Second, while understanding is the first inference people have to draw about the emotional state of another person, it usually is qualified by subsequent inferences and appraisals about the meaning of this state for the relation between its expresser and the perceiver. Thus, future research should include more fine-grained and potentially more reliable measures of subsequent inferential processing that overcome these limitations, potentially leading to patterns of results that can also be aligned with the predictions of the EASI model about the relation between inferential processing and behavioral intentions and responses.

General Discussion

As described above, our research supports the feasibility of emojis as nonverbal cues for digital communication, although it cannot conclusively answer which mechanisms underlie this finding. Furthermore, they also support their functional equivalence to facial expressions in most aspects, but not fully. While we acknowledge that some of the few discrepancies we observed can be attributed to methodological aspects of our work, we also believe that it is equally important to also pay heed to differences between digital and face-to-face communication. In the next section we sketch out what these differences and the limitations of our research are, and how this might explain the observed discrepant results, and how the EASI model could be more thoroughly tested in future research in digital communication settings.

The EASI Model in Digital Versus Face-to-Face Communication

The present experiments were designed to test the most basic premises of the EASI model (van Kleef, 2009). Thus, we made some concessions in terms of the complexity of our experimental designs, which might have affected the observed results.

First, we decided to only investigate very mundane text messages which were clearly valenced and we implemented only simple emotion-congruent emojis (except in Experiment 1d). In addition to the measurement issues discussed above, this might help explain why we observed a bidirectional relation between perceived valence and understanding, rather than an indirect effect of emojis on understanding, mediated via perceived valence. Furthermore, this might also explain why the effect of emojis on understanding was fully mediated via empathic concern. What these results suggest to us is that we created a scenario where the affective pathway within the EASI model clearly has more sway. In defense of this decision, however, it needs to be stated that the mode of communication we chose (i.e., instant messaging between friends) is the most common form of digital communication and we believe that this is the first crucial difference between computer-mediated and face-to-face communication: digital communication is comparatively more uniform, and we believe that our results are reflective of one of the most prototypic instances of digital communication.

However, this does not imply that the EASI model is not applicable to other digital communication settings. On the contrary, what these findings suggest is that clearly more research is needed to fully test the EASI model within the context of digital communication. Future research should aim to create situations that allow for a fair test of the inferential pathway of the EASI model (van Kleef, 2009). Conveniently, the EASI model explicitly proposes at least two moderators that could be used to design such research: information processing capacities and social-relational factors. It should be noted that digital communication compares quite favorably to face-to-face communication in terms of the ability to draw inferences about the message of another person because texting can happen time-lagged (except for some messaging apps like Snapchat, Telegram, Wickr etc.), whereas it would be quite unusual to respond to a face-to-face request only after a longer delay.

However, as the present results suggest that inferential processes are not needed to decode simple text messages, a more fruitful approach would be to increase the content complexity of the messages, and more importantly for the EASI model, the complexity of how emotions are expressed nonverbally in digital communication. More complex emojis have become increasingly popular on Internet streaming platforms like Twitch. Some Twitch emotes convey more ambiguous and/or complex emotions such as sarcasm/smugness (the "Kappa" emote), awe/surprise (the "PogChamp" emote), or pain/outrage (the "SwiftRage" emote) and are interfaced in a more anthropomorphic manner. Most instant messaging apps now also offer animated gifs or "animojis" that mimic expressions dynamically. Previous research has found that more complex emojis are often hard to understand (Miller et al., 2016); for instance, due to culturally different usage (Wolf, 2000) or technical communication aspects (Miller et al., 2016).

In terms of how well the EASI model applies to digital communication settings, it is therefore possible that inferential processes

are the primary determinant of subsequent behavioral effects of emotional expressions only if the meaning of an emoji is relatively ambiguous or unclear. In addition to the limitations of assessing only understanding as an indicator of inferential processing, future research therefore should also investigate digital communication using more complex, emotion-incongruent, or dynamic emojis to provide a stronger test of the inferential pathway proposed by the EASI model (van Kleef, 2009).

Concerning social-relational schemata, we want to emphasize again that the presently tested situation could be considered the default of digital communication. That is not to say that computer-mediated communication does not happen in different contexts, too. Previous research even suggests that emojis in different contexts evoke inferential processing. For example, they are considered inappropriate for digital communication at work and even lead to attributions of incompetence (Glikson et al., 2018). These results are another clear indication that emojis can affect inferential processing. It would be prudent for psychological and communication researchers to experimentally determine the exact impact of these moderating variables on the affective and inferential consequences of emoji use, especially given what is at stake in formal or professional contexts. Given how quickly digital communication (norms) change, this is an important task for now, as well as prospectively.

The second major aspect in which the present research deviated from the EASI model was that instead of observing actual behavior, we recorded a variable that is strongly associated with prosocial intentions (Batson, 2002; Einolf, 2008); but we did not measure any behavioral outcomes. Again, in terms of ecological validity we believe that this decision is justifiable given that compared to face-to-face communication, behavioral options are usually severely limited in digital communication. In terms of internal validity, on the one hand, it could be argued that empathic concern is just another indicator of the affective pathway of the EASI model. However, empathic concern clearly differs from measures of emotion contagion in that it is other-focused (Davis, 1983) whereas emotion contagion is very much self-focused. Thus, also in terms of internal validity we believe that the present operationalization makes sense.

However, future research should also aim to incorporate tests of actual behavioral outcomes in digital communication. Given that the only behavioral option in digital communication usually is texting back, future research could focus on this behavior. A potential solution would be to ask participants to write responses to text messages with and without emojis and to analyze these responses in terms of their emotional intensity. Such validation could be done by different participants or by computer programs (e.g., Pennebaker et al., 2015) that analyze texts according to predefined features, such as emotional intensity. Such criteria could be borrowed from the EASI model to guide the evaluation process for response messages. Finally, such validation could also include criteria like reciprocal emoji use.

Lastly, the observed asymmetry between positive and negative text-messages warrants attention. Throughout most of our studies, emotion-congruent emojis had stronger effects when they were coupled with positive compared to negative messages. Several explanations for this unexpected (yet rather consistent) pattern of results exist. First, given that emojis are a generalization of smileys, by virtue of this name it should be evident that they were originally devised for funny and informal contexts. Thus, in terms of their affective, inferential, and social meaning, people might be less certain what a sad message that at the same time includes a yellow, nonanthropomorphic comedic relief device implies. For positive messages, on the other hand, the functional role of smileys is aligned with the message content and therefore it is possible that the results were stronger in this context.

Second, it is well-documented that positive information has a higher "density" than negative information, that is, positive concepts are more similar to each other than negative concepts (Unkelbach et al., 2008). Thus, another explanation for this finding might be that positive emojis are a priori applicable to a wider array of contexts than negative emoji and this translated into the differences observed presently. To explore this possibility, future research should conceptually replicate the present studies with more discrete emotions, paralleling what has been done for face-to-face communication before, although as we mentioned above it is unclear how well emojis do represent discrete emotions as of now (see, e.g., Miller et al., 2016).

Nonetheless, the effects of emojis on all outcomes were also significant for negative messages except for a few individual comparisons. Even though our power analysis indicated that the actual observed statistical power of the present studies was considerably higher than the conventional level of $(1\text{-}\beta) = .80$ (the observed median power was asymptotically 1), we computed many individual comparisons for negative messages and observing some nonsignificant results is expected based on chance.

Conclusion

In conclusion, the present findings systematically investigated how well emojis can fulfill functions that have been demonstrated for facial expressions of emotion from the perspective of the EASI model. They complement many more specific, yet valuable investigations, that undertook this important task, too. These previous and our findings emphasize that emojis are powerful devices in digital communication, potentially explaining the high popularity that they have garnered in the past. At the same time, they show that clearly more research is needed to keep up with the rapid advances modern technology affords and the speed with which the postmillennial society accepts these changes. This report grounds these challenges in a social–cognitive model of emotions that can help to move emotion research—at least in terms of technology—into the 21st century.

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