



A Cross-Cultural Survey of Emoticon Research Before 2015

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ABSTRACT

Emoticons have emerged as a strong means of enhancing text-based communication, and cross-cultural understanding is important in framing emoticon research. This paper provides a cross-cultural comparison of emoticons by reviewing publications and webpages in English, Chinese, and Japanese. To our knowledge, it is the most comprehensive survey of its type, covering well over 100 papers, including some which have never been translated into English. Note that since this paper was written in 2015, our survey focuses on research published before 2015. We also provide a detailed history of the origins of emoticon use. Our hope is to provide a useful resource for researchers to understand early efforts in the field, and foster continued research in emoticons as used in computer-mediated communication (CMC).

Keywords

Emoticons; Emoji; Survey paper; Computer-mediated communication; CMC.

1. Introduction

Black-and-white text from the early days of computing has evolved into a diverse form of communication that integrates colors, images, video, and other multi-media. In the ever-changing field of computer-mediated communication (CMC), emoticons have become recognized as influential text-based communication enhancements. Originally invented as linguistic markers to signal jokes, emoticons have since become a common element in text-based CMC. Just as all languages evolve due to cultural, historical, and geographical factors, the use of emoticons has similarly evolved within the context of different cultures and historical adaptations. A more nuanced understanding of emoticons must account for these varied cultural contexts. As an example, although many studies consider emoticons in text to be nonverbal cues like facial expressions, which imply emotional states [20], this explanation does not capture some of the characteristics of certain emoticons, especially non-English emoticons. For example, “囧” is a Chinese emoticon that indicates embarrassment via a facial expression (frowning eyebrows and an open mouth). Though it seems similar in appearance to the frowny face “:(”, it is different for two reasons. First, this emoticon can be pronounced as “Jiong”,

which has the same pronunciation as “窘”, meaning “embarrassment” in Chinese. Secondly, 囧 is often paired with 興 to make “囧興”, which is a turtle with an embarrassed face. Turtles carry a negative meaning in Chinese cultures, so it does more than just represent negative emotional states or a nonverbal cue; the meaning is imbued with additional cultural significance that enhances the interpretation of the negative state.

The above example shows that emoticons are sophisticated artifacts that require deeper analysis to fully understand. Despite the numerous studies on emoticon-related issues, gaps still exist, and our understanding of emoticons varies greatly; we posit that a cross-cultural understanding is important in framing the research. This paper draws from existing literature on emoticons as well as emoticon-related webpages and articles to examine common ground as well as to compare varied directions in the research on emoticons. We provide a cross-cultural comparison of emoticons starting from a background section to introduce the history of emoticons in Western world and in Japan, and our survey covers papers in English, Chinese, and Japanese¹, including some that have never been translated into English. We then provide an extensive literature review of emoticons including previous review papers. Note that since this paper was written in 2015, our survey focuses on research published before that year. Since then, a great deal of research related to emoticons has been produced (more recent studies tend to use “emoji” to refer to both emoji and emoticons). Our hope is to provide a useful resource for researchers to understand early research efforts in the field, and foster continued interest and growth in this area of CMC.

2. Background on Emoticons

2.1 Definition of Emoticons

By its literal definition, the word “emoticon” means “emotional icon.” In this paper we define emoticons in a broader sense: any symbol other than words that expresses a nonverbal meaning in icon style can be considered an emoticon.

This definition includes pure text-based emoticons, graphic emoticons, as well as some stickers and images that people use in CMC; it however does not include abbreviations like “881” other than “LOL,” as lol resembles a laughing face as well. Emoticons

¹ These are three languages the authors know.

that follow our definition can be roughly divided into two categories: text-based (e.g., :, ^_^, 冏) and graphic (e.g., 😊).

2.2 History of Emoticons

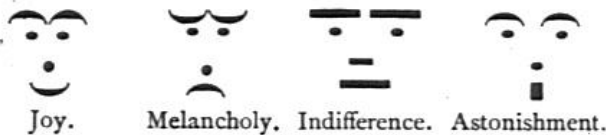
Emoticons gained popularity in the early 1990's, and have flourished over the past three decades. Although some suggest that emoticons were invented in 1982 by Scott Fahlman, a computer science professor at Carnegie Mellon University (CMU), the origin story is more complex, as emoticons did not arise from a single source or person. This paper addresses the many contexts that gave rise to their use and popularity by providing an extensive review of the history of the emoticon.

2.2.1 Typographical Art

One early prototype of emoticons is the “typographical art” in *Puck Magazine* on March 30, 1881, long before the invention of computers, when people were using typewriters. The article stated “We mean to let the public see that we can lay out, in our own typographical line, all the cartoonists that ever walked.” Although they were not created for the purpose of communication, they can be categorized as emoticons under our current definition [30].

TYPOGRAPHICAL ART.

We wish it to be distinctly understood that the letterpress department of this paper is not going to be trampled on by any tyrannical crowd of artists in existence. We mean to let the public see that we can lay out, in our own typographical line, all the cartoonists that ever walked. For fear of startling the public we will give only a small specimen of the artistic achievements within our grasp, by way of a first instalment. The following are from *Studies in Passions and Emotions*. No copyright.



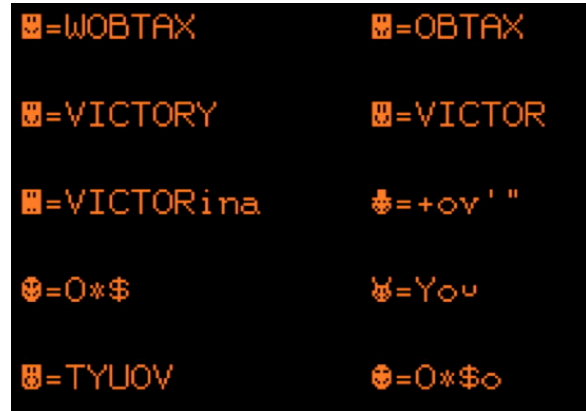
2.2.2 Yellow Smiley Face

Another influential prototype of emoticons is the yellow “smiley face” created in 1963 by Harvey Ball [40, 125]. Although it was designed as a symbol for an insurance company, and was more widely used on buttons, desk cards and posters, the yellow face with two dots and an inverted arch has become a common feature of many graphic emoticons today.



2.2.3 ASCII Art and PLATO emoticons

Dating back to the 1960s, people have attempted to use pure ASCII text to represent graphics, as popularized in the bulletin board systems (BBS) of the 1970s and the 1980s. The PLATO system (Programmed Logic for Automatic Teaching Operations system, a computer assisted instruction system) in the 1970s supported ASCII art and explicitly enabled shortcuts for icons that could be defined as emoticons at the time. Though the PLATO emoticons did not spread as did the later ASCII smiley face “:”), the PLATO HISTORY blog reports that users did adopt these icons and use them to communicate [18].



2.2.4 Proposals to Extend Punctuation

A lesser-known emoticon prototype was proposed by ARPANET user Kevin Mackenzie on April 12, 1979. He wrote to the MSGGroup saying that as a new user, he suffered from lack of nonverbal cues in this medium, and therefore he proposed extending punctuation by symbols like “-)” to indicate tongue-in-cheek. His proposal received primarily negative reactions claiming that emotion could already be expressed through traditional English words. Additionally, Mackenzie was not the first to suggest extending punctuation. As far back as in 1912, Ambrose Bierce, an American journalist and novelist, in his article “For Brevity and Clarity” introduced an improvement to punctuation, ☺, to represent a smiling mouth in writing. Though these proposals did not win wide acceptance, they evinced a desire to express nonverbal meaning via text symbols [72].

15-Apr-79 12:05:26-PST,1142;000000000000
 Mail-from: MIT-MC revd at 12-Apr-79 1740-PST
 Date: 12 APR 1979 1736-PST
 From: MACKENZIE at USC-ECL
 Subject: MSGGROUP#1015 METHICS and the Fast Draw(cont'd)
 To: ~drxal-hda at OFFICE-1

cc: msggroup at MIT-MC, malasky at PARC-MAXC

In regard to your message a few days ago concerning the loss of meaning in this medium:

I am new here, and thus hesitate to comment, but I too have suffered from the lack of tone, gestures, facial expressions etc. May I suggest the beginning of a solution? Perhaps we could extend the set of punctuation we use, i.e:

If I wish to indicate that a particular sentence is meant with tongue-in-cheek, I would write it so:

"Of course you know I agree with all the current administration's policies -)."

The "-)" indicates tongue-in-cheek.

This idea is not mine, but stolen from a Reader's Digest article I read long ago on a completely different subject. I'm sure there are many other, better ways to improve our punctuation.

Any comments?

Kevin

2.2.5 Invention of :-) and :-(

An important milestone for emoticon development occurred on September 19, 1982, when Scott Fahlman posted to CMU's bulletin board system that he proposed to use ":-)" and ":-(" as joke markers to help people distinguish whether a certain segment of text was serious or satirical. This post is from a thread² which started from a conversation about a physics question, and one of the interlocutors sent a "WARNING!" post that was intended as a joke, but later realized it looked like a serious post so he sent another post to clarify and apologize. The conversation thus turned into a discussion of how to represent jokes in posts. Initially Fahlman

proposed using * as the joke maker, but others disagreed and attempted using symbols such as % and #. Finally, Fahlman proposed :-) and :-(, which others adopted, also coming up with others like "(:-O)", "_/\^3", ":-|", and "|-:".

```
19-Sep-82    11:44                Scott    E
Fahlman          :- )

From: Scott E Fahlman <Fahlman at Cmu-20c>

I propose that the following character
sequence for joke markers:

:- )

Read it sideways.  Actually, it is probably
more economical to mark
things that are NOT jokes, given current
trends.  For this, use

:- (
```

This idea spread outside CMU, and was followed by many variations [31]. Today, when people refer to the birth of emoticons, they usually mean Fahlman's 1982 post. In 2002 and 2012, newspapers published special articles celebrating the emoticon's 20th and 30th birthdays. Although it may not be accurate to call Fahlman the father of emoticons, the creation of ":-)" and ":-(" is nevertheless an influential and significant part of the history of emoticons.

2.2.6 Origin of Japanese Emoticons

In Japan, the first emoticon, (^_^)³, appeared online in 1986, four years after the invention of the first emoticon by Scott Fahlman [106]. It was produced by Yasushi Wakabayashi on the online chat system run by ASCII net [121]. To compensate for the lack of nuance in written communication, Wakabayashi had been exploring the use of non-verbal ascii symbols since ASCII net began service in 1985. He produced and used "(^_^)" in the system for the first time in 1986 [84]. According to Wakabayashi, he was unaware of

² The entire thread was recovered by Jeff Baird in 2002, almost 20 years after its first posting.

³ This was intended to be a smile, which is different from an angry face in Eastern style emoticons.

Fahlman’s smiley face at the time he invented his first emoticon. He also pointed out two differences between the first Japanese emoticon and the first smiley face [121]. First, the direction of the face is influenced by language’s writing style: English is written horizontally, whereas Japanese is written both horizontally and vertically. Second, because of cultural differences, English emoticons form expressions based on the mouth, whereas in Japanese emoticon nuances appear in the eyes. At almost the same time, while Wakabayashi was inventing his first emoticon, binbou (internet name, real name unknown) also invented “(-_-)” on ASCII net, inspired by physics formulas, such as “(0|0)”, “<a|b>”, etc. [107]. Both Wakabayashi and binbou claimed that they were unaware of any other emoticons when they invented theirs [107]. After the first emoticons were posted on the ASCII net bulletin board system, users began making changes and producing different emoticons. Emoticons eventually spread to other online communication platforms [58].

2.2.7 Typos or Earlier Creation of Emoticons?

Another story regarding the origin of emoticons is a New York Times transcription of Abraham Lincoln in 1862 [63].

the front of the platform and spoke as follows :
THE PRESIDENT’S SPEECH.
FELLOW-CITIZENS: I believe there is no precedent for my appearing before you on this occasion, [applause] but it is also true that there is no precedent for your being here yourselves, (applause and laughter ;) and I offer, in justification of myself and of you, that, upon examination, I have found nothing in the Constitution against. [Renewed applause.] I, however, have an impression that there are younger gentlemen

“(Applause and laughter ;)” appears in one of the sentences. Some hold the “;)” after “laughter” to be an emoticon, while others attribute it to typographical error. Debate continues as to whether this was the first emoticon; many researchers, including Scott Fahlman, lean toward the position that this was indeed a typo.

Similarly, the poem “To Fortune,” published in *Hesperides* in 1648, contains a line with a “:)” in the end:

Tumble me down, and I will sit
 Upon my ruins, (smiling yet:)
 Tear me to tatters, yet I'll be
 Patient in my necessity.
 Laugh at my scraps of clothes, and shun
 Me, as a fear'd infection;
 Yet, scare-crow-like, I'll walk as one
 Neglecting thy derision.

As with the transcript of Lincoln’s speech, this is generally considered to be a typo [103].

2.3 Other Emoticon Reviews

The literature contains other emoticon reviews, but none provides as thorough coverage as our paper. In this section, we briefly introduce each and highlight their differences from our review.

One of the earliest reviews of emoticon research was written by Ayumu Arakawa [6]; it focuses on emoticon research in Japan from the standpoint of nonverbal communication studies. In the review, Arakawa provides a summary of emoticon usage in Japan, and summarizes research results for different factors (e.g., culture, gender, generations) that impact emoticon use. Arakawa also went further and laid out directions for future emoticon research, including (1) how emoticons impact communication in different conditions, (2) the evolution of emoticon usage, (3) whether an emoticon match with its context impacts its effect, and (4) emoticon expert study. Our review contains some similarities to these groupings, but our overall categorization is different. (We do not have access to all the papers reviewed by Arakawa since many are available in Japan only; similarly, Arakawa’s paper only minimally reviews the literature in English).

Adams (2013) conducts a bibliographic essay of twenty-one emoticon research articles using a grounded theory and comparative methodology to review previous literature [1]. Four themes are identified, finding that emoticons function to 1) affect interactions positively, 2) influence message meaning, 3) manage impressions, and 4) manage nonverbal behavior. Adams further examines emoticon use within a communication theory perspective, looking at whether literature takes on a monologicistic perspective in which senders and receivers transmit messages to each other in an individualized way, or a dialogistic perspective, in which meaning is co-created and the past and the future contexts play a role. The review finds both types of perspectives, with quantitative emoticon research being primarily monologicistic while dialogistic research examines ways of gathering data from natural mediated conversations. In our paper, we also review several studies that examine emoticons from communication theory perspectives, but we go further by collecting studies that investigate emoticons from a more diverse perspective (e.g., psychology, business, literature).

Ptaszynski et al. (2013) provide an overview of emoticon research placing work more generally into two areas [91]: social sciences and communication studies, and natural language processing (NLP), arguing that further work within NLP is needed. The authors create a database of over 10,000 emoticons as the basis for the emotiCon Analysis and decOding of affective information (CAO), a system built for the extraction and analysis of Japanese kaomoji and Eastern-style emoticons. They divide the emoticons into semantic areas such as the mouth or eyes, allowing the system to automatically annotate emoticons with emotion types, with the capability of generating over three million possible combinations. The authors successfully evaluate their system outputs for emoticons at the individual and sentence level, mapping results to specific emotions as well as to Russell’s affective space model. We

review Ptaszynski's work in Section 3.4, and agree that further research is needed for automatic analysis on emoticons. Though this overview provided many helpful findings, our paper examines additional research papers with more diverse directions.

Aldunate and González-Ibáñez (2017) provide a self-described "mini review" of emoticons focused on CMC, language comprehension, and neuroscience [2]. In CMC they cover research areas related to "social presence" and "richness", where results showed ways that emoticons are used as emotional cues similar to face-to-face communication. The authors also address the role of emoticons in assisting in the interpretation of text messages and in producing positive emotional responses in the receiver. The review ventures into more novel territory with descriptions of relevant fMRI and electroencephalography (EEG) research in emoticons. The authors describe study results that illustrated emoticons did not activate the same area of the brain that are activated when processing human faces—as seen by functional magnetic resonance imaging (fMRI)—but that they did activate areas involved in emotional discrimination. They further note a lack of research in EEG and emoticon interpretation, with existing studies showing a similarity to face interpretation (e.g., Churches et al., 2014). We cover neuro-cognitive studies in Section 3.2. Since this paper was published in 2017, the collection includes more recent neuroscience research on emoticons; our paper focuses more on earlier results.

3. Emoticon Research Themes

3.1 Emoticon Influences in CMC

One recurring theme in emoticon research involves the effects emoticons have on CMC. This pattern emerged in the mid-1990s when Rivera et al. in their 1996 poster reported an experiment showing that participants with emoticons available in their remote CMC system felt more satisfied with the system [95]. Thompson and Foulger (1996) studied how emoticons affect the perception of 'flaming' (i.e., hostile verbal behavior) in emails and found that emoticons reduced the perception of flaming when the intensity of hostility was not too strong [113]. Utz (2000) studied the development of friendships in multi-user-dungeons (MUDs), a text-based virtual world, and found that the more emoticons employed by a MUD user, the more friendships they build [118].

Walther and D'Addario (2001) conduct experiments on how emoticons influence chat message interpretation in terms of valence; they show that emoticons' effects are outweighed by verbal content. However, they find that whenever there is a negative component in a message (either a negative emoticon or negative valence text), the message is considered to be negative. In other words, adding a negative emoticon to positive-valence text makes the message negative; this however is not the case in the reverse setting [122]. Since they draw their hypotheses from an extensive body of literature, this paper has been one of the most fundamental and influential papers concerning emoticons, and has triggered many novel research directions.

In 2008, Derks et al. adapted and modified Walther and D'Addario's experiments, finding that emoticons help to strengthen the intensity of a verbal message [27]. In addition, they find that emoticons potentially create ambiguity and can be used to express sarcasm by contrasting the valence of emoticons and that of text (e.g., adding a smiley face :) to a negative valence text.)

In addition to emoticons' influence on messages, numerous studies have focused on emoticons' influence upon the perception of recipients and contexts. Byron and Baldrige report an interactive effect between nonverbal cues and recipient personality in email communication [21]. The results from their experiment show that a smiley face emoticon helps reduce recipient uncertainty of the sender's likability. In other words, recipients are more likely to consider the senders positively in emails received with smiley face emoticons. This effect is also mediated by individual differences such as personality or emotional stability. Hanai and Oguchi (2008) in their text analysis on email exchanges find that emoticons are often used in early stages of communication to soften tense relationships between emailers [36].

Huang, Yen, and Zhang conduct a structural equation modeling (SEM) analysis on the effect of emoticons on instant messenger (IM) messages [41]. They collect their data with questionnaires and propose a theoretical model. The results of their analysis show that users of emoticons notice a positive effect on their enjoyment, level of personal interaction, richness of perceived information, and perceived usefulness of their conversations. Kato et al. (2005) use multiple regression analysis and factor analysis to examine multiple factors of emotion in email expression [55]. They find that emoticons have a variety of influences on the emotion expressed in the email. For example, the receiver may feel happier, or closer to the sender.

Lin, Lai, and Chiou (2010) study how emoticons influence communication behavior in online negotiation (e-negotiation) in IM [66]. They conduct a study with two groups, one using IM with emoticons, and one without. They find that the presence of emoticons in IM increases both positive and negative socio-emotional communication and increases positive task-oriented communication.

Janssen, IJsselsteijn, and Westerink (2014) conduct experiments which show that an increase in the number of communicated emoticons increases perceived intimacy. In addition, user-initiated use of emoticons creates more intimacy between users than automatically-generated emoticons in communication [46].

Arakawa, Takehara, and Suzuki (2006) study how messages with and without emoticons regulate the receivers' emotional intensity [10]. In their within-group experiment, the participants experience four emotional scenarios (happy, sad, angry, and anxious) triggered by written scripts prepared by the authors. After they report their initial emotional intensity under the scenario, they receive a message from a friend reacting to the scenario the participant is experiencing. The message is supplied with/without emoticons

based on the experiment condition ((^_^) (;_;) (>_<) (^_^); m(_ _)m, or no emoticon). The participant then reports the emotional intensity again. The experiment results show that emoticons help reduce the intensity of receivers' negative emotions. In a follow-up study, Arakawa and Kawano further examine the effect of the typeface of emoticons as well as the existence of line-breaks within emoticons [7]. When it comes to receiver emotion, they find that emoticons in the Mincho typeface (a two-byte typeface) are related to reduction of anxiety. However, in terms of the receivers' impression of the messages, neither the effect of the typeface nor line-breaks is significant.

Kato, Kato, and Akahori (2006) compare how the existence of emoticons and the length of a message influence emotion [54]. They find that message length is a stronger variable to trigger anger and sadness and suppressed happiness than the existence of emoticons. In their follow-up studies [51], they further examine the impact of emoticons in short messages, and find that short messages without emoticons are more likely to make receivers experience anger, sadness, and less joy.

Nakamaru (2002) examine the effect of emoticons on the credibility of a passage using a Likert scale-based survey [80]. The results show that when the meaning of emoticons aligns with the content, the respondents assign high credibility, likeability, and appreciation scores to the passage, whereas when the meaning of emoticons and the content are misaligned, the three scores are all low.

Takahashi, Fukada, and Akimitsu (2005) study the impact of emoticons in messages on receivers' anxiety, and consider the difference between gender and personality (trait-anxiety) [110]. They find that emoticons help receivers to reduce anxiety; the effect is remarkable for women with high trait-anxiety. They also find the anxiety level of men with low trait-anxiety decreases even without emoticons. They conclude that the impact of emoticons on receivers' anxiety reduction may be mediated by gender and personality.

Arakawa and Suzuki (2004) focus on the impact of emoticons in apologetic messages [9]. In a study of 28 female Japanese college students, they find that the "m(_ _)m" emoticon (a person who kowtows to apologize) reduces the receivers' anger the most, compared with no emoticon, the smiling face "(^_^)", and the sad face (;_;) . Therefore, emoticons not only show the sender's emotion, but also change the receiver's affect.

Taguchi (2014) investigates the impact of both emoticons and Japanese small letters (e.g., using ありがとう instead of ありがとう to say thank you in text messages) [108]. From a study with 94 Japanese university students, the author finds that the use of both emoticons and small letters makes the message seem more youthful and less sincere than no use of both. However, using emoticons solely enhances the impression of intimacy expressed through the message. Harada (2004) studies how emoticons are used to promote smooth communication and express consideration and politeness in Japanese [37].

3.2 Mechanism of Emoticon Function in CMC

Though emoticons initially emerged as joke markers, they now function in more complex ways. One research theme around emoticons focuses on their roles in CMC and how they function. In face-to-face communication (FtF), social interactions and their corresponding meanings are usually conveyed through non-verbal behavior (e.g., body language, eye contact, tone of voice). Such non-verbal behavior was not supported in early CMC environments [122]. Therefore, numerous studies consider or even argue that emoticons are non-verbal cues in CMC. For example, Derks et al. (2008) conclude from their experiments that emoticons work in the same way as non-verbal behavior in FtF [27]. Dresner and Herring suggest that since early versions of emoticons focused on imitating facial expressions (e.g., a smiley face :-)), these emoticons map directly onto facial expressions [29]. However, some studies also point out that unlike many non-verbal behaviors in FtF, emoticons are generated intentionally as visual cues [69, 122]. Yuasa, Saito, and Mukawa (2006, 2011) in their fMRI studies also note the absence of any clear face recognition process in the brain when recognizing emoticons [137, 138]. Therefore, instead of considering emoticons as pure non-verbal cues, Lo (2008) terms them "quasi-nonverbal cues" [69], and Walther and D' Addario consider them possibly to be graphic display [122]. Some studies also refer to emoticons as paralinguistic cues or para-verbal cues [3, 73]. Sukyadi, Setyarini, and Junida (2011) also find that some words have been replaced with emoticons in forum communication [104], as modern emoticons have become more sophisticated and more like pictures than just simple text-based facial expressions. Markman and Oshima (2007) and Provine, Spencer, and Mandell (2007) both find that emoticons punctuate sentences [71, 89], and Amaglobeli (2012) also finds emoticons to be structural markers, playing a significant role in the formation of the sentence [3]. These findings suggest that emoticons may also have verbal functions.

Additionally, while most studies emphasize the emoticon's role as a device for emotion (the term after all comes from "emotional icons"), some studies articulate the social functions of emoticons: Skovholt, Grønning, and Kankaanranta (2014) conclude that emoticons can function as generators of a positive attitude when following signatures in emails. They can also be joke or irony markers when following utterances which were intended to be humorous. Furthermore, they can be strengtheners or softeners of the sentences [102]. Dresner and Herring (2010) also come to similar conclusions: in addition to emotional facial expressions, emoticons have non-emotional meanings that can map onto facial expressions, for instance, indicating joking intent. They also describe emoticons as an illocutionary force that, for example, tones down a complaint [29]. Markman and Oshima (2007) find that emoticons serve as turn-construction units which indicate continued participation and give someone else the floor in the communication [71]. In Arakawa and Kawano's study, they suggest that emoticons may work as propositions on message impression, but as images on receivers' emotions [7].

Matsumoto et al. (2005) and Nakamaru (2004) use EEG and fMRI respectively to examine how reader brain signals differ when reading emoticons and other stimuli like text or pictures [74, 79]. Further studies are required to identify how emoticons are processed in the human brain.

3.3 Factors that Affect Emoticon Usage

One of the most notable themes in emoticon research considers factors that affect emoticon usage. Researchers focus either on suggesting new factors that influence the number and variety of emoticons, or on conducting empirical studies to test correlations between emoticon usage and other factors. Some example factors are user gender, emoticon valence, conversation context, and interlocutor culture and language. This topic focuses on interpreting and parsing the dynamics in online text communication. In the following subsections, we group factors from the literature and summarize each factor.

3.3.1 Gender

A large number of early studies of exclusively binary gender difference in expressing emotion were produced [19]. There was a strong interest at the time in identifying gender differences in emoticon usage and interpretation. Witmer and Katzman (1997, 1998) found that women use more graphic accents in chat, referring to emotional, artistic, and directional devices such as emoticons [126, 127]. Tossel et al. (2012) in a 6-month longitudinal study of emoticons in text messaging from smartphones found that women send more messages with emoticons but men use more diverse emoticons [115]. Wolf (2000) examined emoticon usage among different genders in a set of newsgroups [128]. She categorizes these newsgroups into predominantly male, predominantly female, and mixed-gender newsgroups. She finds that predominantly female newsgroups generate more emoticons than predominantly male newsgroups. However, there is no significant difference between genders in the mixed newsgroups. Additionally, she finds that when switching from single-gender dominant newsgroups to mixed-gender newsgroups, men seem to adopt the women's

Table 1. Early emoticon research on binary gender as a factor in emoticon usage

Paper	Year	Media	Country	Conclusion
Witmer & Katzman	1997	Chat	?	F > M
Wolf	2000	Newsgroups	USA	F > M (between groups) x (within mixed groups)
Huffaker & Calvert	2005	Blogs	USA	M > F
Tung & Deng	2007	E-learning	Taiwan	X
Chiang & Tsai	2007	BBS	Taiwan	Mixed-gender context > pure-gender context
Brunet & Schmidt	2010	Chat	Canada	F > M (with webcam) x (without webcam)
Lour et al.	2010	Chat	Taiwan	x (intention) Positive emoticon in simplex task-oriented context has effect only on female participants
Tossel et al.	2012	SMS	USA	F > M in terms of numbers M > F in terms of diversity
Liu	2012	Questionnaires for emoticon recognition	Taiwan Japan USA	F > M F > M M > F
Kato et al.	2007	Email	Japan	Mention different uses only, not frequency

standard of expressing more emotions. Moreover, she codes the emoticons into 10 meaning categories and finds that women seem to produce more diverse categories of emoticon meanings. These categories, including solidarity, support, assertion of positive feelings and gratitude, are absent from men's responses. Similarly, Chiang and Tsai (2007) find in a Taiwanese BBS system that both men and women produce more emoticons of embarrassment in mixed-gender conversation than in single-gender conversation [25].

In contrast to Witmer and Katzman and Wolf, Huffaker and Calvert (2005) find in teenage blogs that on average men use more emoticons [43]. Brunet and Schmidt (2010) find in their chat experiments that when participants chat with webcams, women seem to use more emoticons. However, given no webcam, there is no significant difference [21]. Tung and Deng (2007) study the influences of the emoticon style (static and dynamic) on children's attitudes toward e-learning environments; they observe no gender difference [119]. Lour et al. (2010) study emoticon use in workplace IM, and also find no gender difference in the intention of using emoticons; they do however find that only female participants are influenced by positive emoticons in a simplex task-oriented context [73]. Liu (2012) in a questionnaire-based study investigates emoticon recognition among college students with different genders and in countries including Taiwan, Japan, and USA. The results reveal no consistent overall gender difference, but if the results are separated by country, female students in Taiwan and Japan yield higher recognition scores than male students; American male students have higher scores than female students.

Kato et al. (2007) in their experiments with 32 college students ask participants to determine the gender of the email senders [56]. The results seemed to show that emoticons may be used to differentiate genders of the sender. This study was conducted in Japan, and the conclusion may be aligned with gender stereotypes.

In Table 1, we summarize the results from the studies. These results are inconsistent, as one might expect; before 2015 few researchers considered gender to be socially constructed and often were unaware how cultural and situational variables may explain some of the differences [19].

3.3.2 *Context and communicator relations*

A popular research question looks at how conversational context influences emoticon usage. Derks, Bos, and Jasper (2004) manipulate the context (socio-emotional vs. task-oriented) and the valence (positive vs. negative) of chat in their between-subject experiments and find that participants use more emoticons in a socio-emotional context than in a task-oriented context [28]. Furthermore, they observe an interaction between context and valence: with positive valence, there is no significant difference between socio-emotional and task-oriented contexts, but in cases of negative valence, the socio-emotional context participants use more emoticons, while the participants in task-oriented contexts use fewer. This is supported by results from a questionnaire-based study where Xu, Yi, and Xu (2007) find that more emoticons are

used if an IM conversation is socio-emotional, and fewer if the conversation is task-oriented [129]. Chiang and Tsai (2007) also find that on a BBS, emotion-oriented conversation produces more emoticons than information-oriented conversations [24]. Consistent with these results, Yigit (2005) in his master's thesis describes experiments conducted on the usage of emoticons on discussion boards in different contexts (socio-emotional vs. task-oriented) [134]. The results indicate that participants in socio-emotional contexts find emoticons to be helpful in expressing their thoughts and affect and understanding others' ideas and feelings. However, participants in task-oriented contexts find it was more helpful to have no emoticons. The author concludes that this might be due to task-oriented contexts having right and wrong answers to discussion topics.

The relationships between communicators were examined in the context of conversation. Derks, Bos, and Jasper (2008) conduct an experiment that extends their previous work, adding communicator relations as another manipulated variable (friends vs. strangers). They find that more emoticons are used in communicating with friends than with strangers [26]. They also find that emoticons are used primarily to express emotion and humor, and to strengthen a message. Ayumu et al. (2006) similarly find that when interacting with closer friends, people use more emoticons and have better impressions of the use of emoticons [8]. However, Xu, Yi, and Xu (2007) observe no significant relationship between emoticon usage and communicator relationship [129]. They find that the perceived personality of the recipient influences the sender's emoticon usage: People use more emoticons when they believe the recipient of their messages to be inventive, curious, and open to new ideas and change. If they perceive the recipients of their messages to have higher degrees of conscientiousness, such as more goal-oriented personalities, they use fewer emoticons. There is no significant impact when the perceived personality is extroverted, agreeable, or neurotic. Kato et al. (2005) study mobile phone text usage [53], finding that participants tend to use more emoticons when communicating with friends and avoid using emoticons when texting their teachers. Kato et al. (2008) further examine how intimacy impacts emoticon usage [52], and find that when texting more intimate friends, participants tend to use more emoticons and reduce the use of verbal text; when it comes to apology, participants also tend to use emoticons to replace textual apologies. Arakawa (2004) in a qualitative study also finds that receivers have an impact on how senders use emoticons [5].

3.3.3 *Valence*

The valence of context and emoticons also influences emoticon usage and interpretation. Derks, Arjan, and Jasper (2004) find in their chat experiments that despite the lack of a main valence effect in contexts, participants in positive contexts use more positive emoticons, whereas participants in negative contexts use more negative emoticons [28]. However, in their follow-up study in 2008 [26], they do find more emoticons are used in a positive context than in a negative context.

Ganster, Eimler, and Krämer (2012) conduct a questionnaire-based study of the influence of emoticons on a person's perception [32]. They find that the writer of the messages is perceived to be more extroverted when positive rather than negative emoticons are used in the message. They also find that recipients report their mood less positively when the conversation contains negative emoticons, as opposed to when it contains positive or no emoticons. Furthermore, when the messages are supplemented with positive emoticons, the recipients evaluate them as carrying more humor.

Kato et al. (2006) and Yanagisawa et al. (2007) both investigate emotional interpretations of positive and negative emoticons in cellphone communications [49, 132]. They find that negative emoticons tend to have a higher variety of emotional interpretation as opposed to positive emoticons. This effect mostly decreases when the emoticons appear with text. However, two emoticons, “(^Q^)/^” and “(·_·)”, yield more diverse emotional interpretations with text. Their explanation for these results is that these emoticons contain ambiguous nuances of meaning.

Lour et al. (2010) study the effect of emoticons in *simplex* and *complex* task-oriented communication [70]. Their definition of “simplex” task-oriented communication includes simple tasks such as scheduling a meeting, whereas complex task-oriented communication refers to more complex tasks like discussing a solution to a problem. They find that negative emoticons can make both simplex and complex task-oriented communication more negative. In contrast, positive emoticons only create positive effects in complex communication. They also find no significant effect for neutral emoticons in either type of task-oriented conversations.

To study the effectiveness of emoticons in expressing emotion, Kawakami (2008) conduct a survey study [56] collecting 185 participants' assessments on 31 different emoticons' emotional expressiveness in six dimensions (pleasure, sadness, anger, happiness, hasty, and surprise) plus intensity. The results were compiled into a database for use in further studies.

3.3.4 Culture and language

Another factor that has been gaining interest in recent years is the connection between culture and language. Janssen and Vogel (2008) analyze newsgroup discussions of politics and science in German, Swedish, English, and Italian [45]. Though they find no significant differences in the overall use of emoticons, they do find that in political newsgroups, the Swedish tend to use more positive emoticons while Italians tend to use more negative ones. In 2010 [119], they continue the analysis of political newsgroups. Among 274,465 posts from September 2006 to February 2008, they find a tendency for Germans and Swedish to use more positive emoticons and Italians to use more negative emoticons.

In 2011, two studies compare the emoticon use of Asian countries with Germany, where the authors believed Asian countries represent more collectivistic cultures while Germany was more individualistic. Li, Rau, and Hohmann compare IM usage between

China and Germany [64]. They find that Chinese users produce emoticons more frequently to increase response speed, prefer using multi-party chat, and seldom send messages to offline contacts. Similarly, in Pflug's study of forum usage among India and Germany, he finds that Indian users use more emoticons than German users [86]. He concludes that this reflects the higher importance of nonverbal communication in a more collectivistic culture.

Halvorsen (2012) studies ESL students' emoticon usage in forums [34]. He finds that individual usage patterns vary significantly. In addition, students' previous experiences of using forums and emoticons in their first language are also identified as mediating factors of their emoticon production behavior.

Park et al. (2013) analyze 1.1 billion tweets among 10 million users across 15 countries [85]. These countries include both Western (USA, UK, Canada, Australia, Germany, Netherlands, France, Italy, Spain, and Mexico) and Eastern cultures (Japan, Indonesia, South Korea, Philippines, and Singapore). They categorize emoticons into horizontal and vertical styles. In the horizontal style (e.g., :) and :(, expression is based on the mouth shape and readers must rotate their head left 90 degrees. In the vertical style (e.g., ^^ and T_T), expression is based on the eye shape. They analyze the proportion of the styles in each country and conduct multidimensional scaling.

They find that tweets from Japan and South Korea contain more vertical emoticons than most other countries, and they cluster the countries into two major groups: East Asia and the rest of the world. They then compare the language composition across countries and find that in some countries, emoticon style is determined by the language of the speaker. For example, the vertical-style emoticons in Netherlands are written in English, while the horizontal-style emoticons are written in Dutch. They claim that their studies show that emoticons are based on socio-cultural norms, whose meaning can vary depending on the identity of the speakers. They also show that these norms are propagated through the Twitter @-reply network.

3.3.5 Other factors

In addition to the factors in the previous sections, other factors may also influence emoticon use or interpretation. Liu (2008) in her master's thesis analyzes emoticon style and composition in Taiwan, Japan, and China. She finds that the style and composition of emoticons in a country is related to the input methods used [68]. For example, the emoticon “囧” (a Chinese word symbolizing an embarrassed face) that is frequently used in Taiwan and China is seldom used in Japan because it is not a word that Japanese input methods can produce. Similarly, Japanese emoticons often use the Russian letter “Д” to represent a mouth. As this letter is difficult to produce in input methods used in Taiwan, Taiwanese people seldom use it. She also claims that this is why English style emoticons such as :) or =_= are universal – most countries use

input methods that can produce English letters and symbols, making these emoticons easily available.

Besides availability, interpretability and frequency are also factors that influence whether an emoticon is used. Cao and Ye (2009) investigate emoticons on *Sina Forum* and find that emoticons that can be interpreted quickly are used more often [22]. They also indicate that emoticons are used by readers to reduce mental labor and concentration, thus speeding up communications. Similarly, McDougald, Carpenter, and Mayhorn (2011) find a positive correlation between emoticon interpretability and frequency [75]. Correlated with these results, Toratani and Hirayama (2011) conduct a factor analysis to categorize emoticons into six emotions: happy, sad, fear, anger, surprise, and disgust [114]. They find emoticons for happy and sad emoticons to be relatively common; emoticons for other emotions are relatively scarce. They hypothesize this imbalanced distribution of emoticons may be related to frequency and interpretability. Nakamaru (2005) analyzes the effect of the number of spaces between text and emoticons and finds that the more spaces there are, the less feeling, joy, and reliability experienced by the recipients [78].

Emoticon style may also influence usage. Ganster, Eimler, and Krämer (2012) study both text-based emoticons (e.g. :) and graphic emoticons (e.g. 😊) and find no difference in message interpretation between the different styles of emoticons, but that graphic smileys have a stronger impact on personal mood than text-based smileys. Furthermore, only graphic smileys have an impact on what the authors term “a writer’s commitment,” a factor derived from a factor analysis [32]. Markman and Oshima (2007) investigate English style emoticons (e.g., :P) and Japanese style emoticons (e.g., ^_^) and find Japanese emoticons to be more varied and more complex [71]. They also suggest that Japanese style emoticons may be more similar in function to nonverbal communication in FtF communication, especially considering that some Japanese style emoticons are representations of directly embodied acts (e.g., φ(• ∇ • *), an emoticon that represents the action of writing). Tung and Deng (2007) study the relations between social presence and emoticon style (static and dynamic) for children in e-learning environments [116]. In their study, they use either static or dynamic (i.e., animated emoticons) emoticons to accompany instructions in e-learning environments and use questionnaires to measure children’s social presence and intrinsic motivation. Their experiments show that children under the dynamic-emoticon condition perceive a higher level of social presence and report greater intrinsic motivation than those in the static-emoticon condition. They conclude that having dynamic emoticons as social cues in e-learning environments may increase children’s motivation for learning. Schnobelen (2012) in his doctoral thesis for affective linguistic resources points out that Twitter users tend to have “emoticon dialects” [99]. E.g. if people type one emoticon with a nose, they use noses for others. Those who use emoticons without a nose are similarly consistent. In other

words, people who use :-) as a smiley face use :- (as a frowny face. Similarly, if someone uses :), then they use :(, not :- (.

Furthermore, the emotional state of a message sender may also affect their emoticon production behavior. Kato, Kato, and Scott (2009), in a study of emoticons in cellphone emails, find that the selection and use of emoticons is positively correlated to the sender’s emotional state [50]. However, the use of emoticons decreases as the emotional strength increases. They also find that if the emotional state is strongly negative (e.g., anger), the sender tends to reduce their use of emoticons.

Krohn (2004) advocates teaching emoticon use in email communication in business school education [59]. He suggests a strategy of using emoticons based on the recipient’s generation: If the recipient was born before 1946, there should be no emoticons in the email. If the recipient was born between 1946 and 1964, there probably should not be emoticons in the email. For those born between 1964 and 1980, some commonly used emoticons may be sent. For people born after 1980, emoticons may be used freely. Though there was no experiment or data analysis in the study, it suggests a perception of generational differences in the usage and understanding of emoticons.

Visibility of conversational partners may also affect emoticon production behavior. Kim, Frank, and Kim (2014) in their chat experiment find that participants use more emoticons when they can see their conversational partners [57].

Moreover, social status or professional level may also influence the frequency of emoticon use. Vogel and Sanchez (2012, 2013) in their two studies on a technical forum find that novice users and users who do not receive kudos tend to use more negative emoticons, while experts and users who receive kudos tend to use more positive emoticons [97, 120].

3.4 Emoticons and Automatic Processing

Another theme in emoticon research is their relationship with automatic processing. This can be roughly categorized into two groups: one where emoticons are used to aid automatic processing, e.g. sentiment analysis, and the other where automatic processing is applied to emoticons, such as computational models for valence of emoticons. We discuss these two groups separately below.

3.4.1 Using emoticons to aid automatic processing

This category primarily involves sentiment analysis in web content, including chat logs, blogs, and other social media like Twitter. In this area, emoticons are used as a sentiment feature. As online media have become more popular in recent years, more work of this kind has emerged. Mishne (2005), Yang, Lin, and Chen (2007), and Ptaszynski (2014) use emoticons to classify the emotional states of blog posts [76, 92, 133]. Sasayama and Matsuo (2010), Ku and Sun (2012), Rojas, Kirschenmann, and Wolpers (2012), and Brooks et al. (2013) apply emoticons to detect emotion and affect in chat logs [20, 60, 96, 98]. Hamouda and Akaichi (2013)

investigate Facebook users' sentiment toward the events happening during the "Arabic Spring" era [35].

After Twitter became popular, studies began to focus on sentiment analysis of tweets. Cui et al. (2011), Liu, Li, and Guo (2012), Purver and Battersby (2012), Boia et al. (2013), Hogenboom et al. (2013), and Montejo-Ráez et al. (2014) analyze the sentiment of tweets with emoticons as features [17, 25, 38, 67, 77, 93]. In addition, Zhao et al. (2012) conduct sentiment analysis with emoticons as features on *Sina Weibo*, the Chinese Twitter, [140]. Moreover, Ghiassi, Skinner, and Zimbra (2013) use emoticons to detect Twitter user attitudes toward brands [33]. Since we focus primarily on emoticon usage, the details of sentiment analysis are beyond the scope of this paper. Such details can be found in work such as Balahur, Mihalcea, and Montoyo [14].

In addition to sentiment analysis, Zhang et al. (2013) observe that as the number of emoticons in text streams usually peaks with hot events, they can use emoticons to detect bursty events on Sina Weibo [139]. Yamashita, Tani, and Takami (2008), Takami et al. (2009), and Yamashita, Yamaguchi, and Takami (2010) build a music recommendation system based on the user's state of mind and preferences, which is inferred from emoticons [111, 130, 131]. Furthermore, Tahara et al. (2012) suggest using emoticons to automatically detect authors of articles [109]. These studies demonstrate how emoticons are an increasingly important element in web content-related research.

3.4.2 Automatic emoticon processing

One topic in automatic emoticon processing is an automatic emoticon recommendation system. Suzuki and Tsuda (2006) apply morpheme analysis to text to detect emotion and automatically add emoticons based on their emoticon dictionary (a mapping between emotion and emoticons) [105]. They achieve an 87.7% correction rate in their experiment. They suggest using such a system to facilitate e-business communication. Similarly, Urabe, Rzepka, and Araki (2013) describe a system for a Japanese input method that recommends emoticons when users are typing on their smartphone [117]. The system recommends emoticons based on the emotion detected in the text. Their results showed that 71.3% of user-selected emoticons were those listed in the top 10 recommended emoticons. Instead of recommending emoticons, Ishiguma and Wakuya (2006) go further, exploring the possibility of generating emoticon patterns automatically [42] by using backward projection of a self-organized feature map (SOM).

Emoticons have been inserted into dialogue systems to make conversations with machines more natural. For example, Nakamura et al. (2003) build a three-layer neural network to learn components of emoticons (e.g., eyes, mouths, face) and automatically generate and insert emoticons into conversations [81]. Shiina et al. (2012) also propose using semi-supervised learning to build a natural dialogue system to insert emoticons into conversations automatically [100].

Another related topic in this area is automatic evaluation of the emotion or sentiment of emoticons. Aoki and Uchida (2011) propose generating emotional vectors of emoticons [4]. They define 14 dimensions of these vectors based on Plutchik's emotion model [87, 88], and build a dictionary of emotional words for each dimension. The values of an emoticon's emotional vector are calculated based on the co-occurrence of the emoticon and the emotional words in each dimension. Tanioka and Maruyam (2012) decompose emoticons into morphological features and use SVM to learn to infer meanings of emoticons [112]. Wang et al. (2013) suggest two methods to predict the semantic orientation of emoticons [123]. In the first, the symbol-pair method, they collect 108 emoticons and simplify them into 80 seed emoticons by removing spaces, Chinese words, and duplicates, after which they label these emoticons as positive, negative, or neutral. Then they automatically detect elements such as eyes in these emoticons and categorize the valence of these elements based on the emoticon valence: if the emoticons that contain a specific element are all of the same valence, then this element belongs to this valence. Otherwise this element is neutral. For example, as all emoticons containing ^ are positive, ^ is labeled positive. For a new emoticon which is not included in the 80 seed emoticons, they predict its semantic orientation by voting among the elements it has. If the emoticon has more positive elements than negative, then its semantic orientation is positive. If it gets the same number of positive and negative votes, it is deemed neutral. Their other method, the substring method, relies on the similarity between the emoticon to be predicted and the seed emoticons, which is calculated as the length of their longest common subsequence divided by the length of the seed emoticon. The predicted semantic orientation is decided by the semantic orientation of the most similar seed emoticon. They apply both of these methods, yielding an accuracy of 78% for the combined method (using a decision matrix for the results).

Ptaszynski et al. (2010) propose the CAO system [90] (pronounced Ca-O, the same pronunciation as the Japanese word for *face*: 顔=かお=Ka-O). This automatically detects emoticons in text based on potential emoticon symbols. In addition, it outputs the predicted emotion (10 emotions based on Nakamura (1993)) using a database containing ten thousand emoticons. If an emoticon does not exist in the database, it segments the emoticon into semantic areas, including left eye, mouth, right eye, face boundary, and the spaces between these. It then uses the combination of the semantic areas to predict the emotion. The accuracy of their results in their experiments is around 80%.

3.5 Other Research Themes

Aside from the four research themes in the previous sections, there are many other areas of research regarding emoticons and their applications.

One way that emoticons are utilized in these research papers is as a study stimulus. Jolij and Lamme (2005) use emoticons in a

transcranial magnetic stimulation study for affective blindsight [47]. Lee et al. (2008) use emoticons as a simple screening tool for depression among elders within a month after their first stroke [62]. Shin et al. (2008) in a fMRI study use picture-style emoticons as a stimulus and compare brain activities with real-face stimulus results [101]. Narayanan and Sekar (2009) place emoticons on a scale used for investigating work culture [82]. Bernard and Cannon (2011) use emoticons in questionnaires as well as for a motivation scale [16]. Ayres, Raseman, and Shih (2013) find that emoticons can be used in feedback from peers to save energy [11]. Though these studies do not directly focus on emoticons, they show that emoticons may play a role in other types of studies.

Additionally, Azuma and Maurer (2007) and Azuma and Ebner (2008) suggest graphic emoticons as a next-generation universal symbolic language, proposing emoticons as an auxiliary visual language that can be used and understood across countries and languages [12, 13]. As Li, Chang, and Chang (2007) see emoticons as insufficient to communicate emotions, they create face-based icons derived from a photo and produce a set of face-based icons for expressing emotions [65]. Kanayama (2003) also report that elderly people employ various online languages to express themselves, including emoticons [48]. Chang and Wang (2010) report in a study of web-based online cognitive therapy that emoticons can help therapists understand clients' emotional states [23].

Furthermore, Reddy (2004) in his master's thesis proposes the use of emoticons to communicate emotion with virtual agents [94]. Kuantama, Setyawan, and Darma (2011) use emoticons as the face of robots to show the emotional states of the robots [61]. Ito and Munemori (2008) study participant perceptions about emoticons and apply their results to an emotional character (a virtual chat agent) for showing emotions [44]. Berengueres et al. (2013) use emoticons as visual feedback with recycle bins [15].

Network security studies sometimes also involve emoticons. Wang et al. (2009) propose a mechanism for transferring secret codes with emoticons with reference to the emoticon positions [124]. Nayeem et al. (2012) suggest an emoticon-based CAPTCHA system: instead of using numbers or words, they ask users to choose proper emoticons [83].

Last but not least, Holm, Holm, and Seppänen (2010) conduct a survey for assigning music genres to emoticons [39]. Ito and Fujimoto (2013) focus on designing a new interface for inputting emoticons [43], and Yoshida et al. (2006, 2007) attempt to use touch sense feedback to input emoticons [135, 136].

4. Conclusion

This survey covers a rich set of emoticon papers published before 2015. Despite the focus on early literature, it is still valuable to review past work in order to understand the full history of emoticons when conducting emoticon research today. Emoji will only become more popular and widely used, given that they have

become part of the standard Unicode set and are available for many input methods. Thus, it is important to have a solid understanding of emoticons to enable deeper comprehension of text communication. This review aims to provide such guidance to future emoticon research. More work should be done in this area to connect current research with past work.

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