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The influence substitution of nouns and verbs in emoji on processing a sentence

Testing the comprehension, reading ⏰(time), accuracy and perceived 😂 (fun)

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ABSTRACT

The aim of this study was to find out the impact of substituting emoji, the small digital images or icons used in texting programs, for nouns and verbs in sentences. Previous research mostly examined images as substitutes for nouns at the ends of sentences. No research has yet been done to explore the differences in how nouns and verbs are understood and enjoyed when substituted with emoji in sentences

To find an answer to the research question; *"How might substituting emoji for nouns and verbs influence the processing of a sentence?"* an online experiment was conducted. In the experiment 72 participants read 32 sentences (word by word) where the nouns or verbs were either normal words or substituted by emoji. Also, contrasts were included where the emoji typically placed as nouns or verbs were switched (i.e., a noun as a verb and a verb as a noun). The understandability of a sentence was measured with three variables: The time the participants spent reading each word of the sentence, the accuracy with which the participants recognized missing words, and the comprehension ratings that participants gave to the sentence. Participants were also asked how much they enjoyed the sentence, to find out whether emoji substitutions lead to more fun.

The findings indicated that people spent more time reading sentences with emoji substitutions than those with normal words, but emoji substitutions placed in the expected positions led to shorter reading times than did emoji substitutions placed in unexpected positions. For the emoji substitutions placed in the expected positions, the ratings for comprehension, accuracy, and perceived fun were higher than those for emoji placed in unexpected positions. The noun position and the verb position were both easy to comprehend. The findings suggested that emoji can substitute for both nouns and verbs, provided that they are placed in the expected positions.

Keywords: Emoji, sentences, self-paced-reading method, reading time, comprehension, accuracy, understanding, perceived fun, noun substitution, verb substitution

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INTRODUCTION

Emoji, the small digital images or icons used in texting programs, are the fastest-growing communication tool worldwide, and are used by 92% of the online population (Shaul, 2015). Emoji have increased in popularity in texting since Oxford Dictionaries selected an emoji as the (new) word of 2015. Survey results showed that 72% of 18- to 25-year-olds in the UK find it easier to express their feelings through emoji than through the written word (Doble, 2015). Emoji have also become easier to integrate into texting, as recent innovations in messaging tools (Apple, WhatsApp) provide 'emoji suggestions' which offer users potential emoji for replacing words as shown in Figure 1 (Burgess, 2016). Emoji constitute a communicative system that enables people to communicate emotions, actions, or impressions that we cannot express in text. They are dominating today's message and social media apps, as six billion emoji are sent every day (Mora, 2016). The emoji can be entertaining to use at the end of a sentence when it fits the emotion of the message, or it can be used to replace words in a message or even a full sentence. The first book with emoji instead of words was introduced with the translation of the book *Moby Dick* (Radford, Chrisholm, Hachey & Han, 2016), and it resulted in a much higher rate of repetition compared with full-text stories. Given the increasing popularity of emoji, as well as the increasing ease with which they can be integrated into sentences, we can ask, *how might substituting emoji for nouns and verbs influence the processing of a sentence?* The aim of this master thesis was to test whether emoji substitutions for nouns and verbs has influence on the processing of sentences by measuring reading times, comprehension ratings, accuracy ratings and perceived-fun ratings in an online experiment.

Figure 1. *Emoji suggestions in iOS for substituting words by emoji.*

THEORETICAL FRAMEWORK

The word "emoji" is an English adaption of the Japanese 絵文字. Emoji literally means "picture" (e) + "character" (moji), and can be used as a singular or plural noun in English. The term was introduced in 1999, and since then emoji have become the new generation of emoticons, which are keyboard symbols that characterize human facial expressions, e.g. ;) (a winking face) (Novak, Smailovic, Sluban & Mozetic, 2015). Emoji are not the same as emoticons. Emoticons are created from ASCII character sequences, and are interpreted as 'emotion icons' to show facial expressions-for instance a smile in the absence of non-verbal cues (Walther & D'addario, 2001). Emoji are full images, examples of which are shown in Figure 2. A total of 1.851 emoji characters are supported on the current platforms included in Unicode 9.0. Emoji are available for iOS, Android, Windows and OS X (Emojipedia, 2016).

Figure 2. *Examples of emoji*

Emoji represent not only facial expressions and emotions, but also ideas or concepts, such as 'party', 'weather', 'vehicles', 'food', 'animals' etc. (Novak et al., 2015). Shigetaka Kurita, a telecommunications worker, who incorporated symbols from manga (Japanese comics), created the first emoji in Japan. One of the best known is the smiley (☺), which American graphic artist Harvey Ross introduced in 1964. He created the smiley so that a company could give employees smiley buttons to boost their morale (Danesi, 2017). Since 2011, the emoji of Kurita have been used worldwide, as Apple included these emoji in its Operating System 5 (iOS5). The picture-words of Kurita are now used in digital communication across the globe, and with the increasing

use of smartphones the emoji have become extremely popular to use in communication (Danesi, 2017). Emoji are used in different ways. Danesi (2017) analyzed 323 text messages, which students of the University of Toronto write, to explore the functions of the emoji. He found that emoji were primarily used to convey emotions, possibly to visually emphasize points of view (Danesi, 2017). However not all emoji are used for their pictorial meanings. An interesting example of this, is the use of the peach emoji, which can be used to mean either a peach or a butt, and has experienced an evolution as shown in Figure 3 (Raymundo, 2016).

Figure 3. *The evolution of the peach emoji of iOS.*

In face-to-face communication people use gestures and non-verbal communication to support their spoken language (Gunawardena, 1995). They cannot use physical gestural cues in (online) written communication, so emoji can help us to add non-verbal cues in text and thus enhance and enrich text in digital conversations and interactions (Cohn, 2015). A theory related to computer mediated communication (CMC) shows that the limited cues available in CMC make people more reliant on the cues that are available, such as visual cues as detailed in social information processing (SIP) theory by Walther (1992). The SIP theory states that people are intrinsically motivated to reduce interpersonal uncertainty, form impressions of one another, and adapt their interpersonal communication to whatever cues remain available in CMC e.g. emoji. In addition, people use emoji to structure their thoughts in text-based communication (Walther, 2011). Emoji are good examples of visual cues that can be used in CMC to increase the interaction between grammar and visual cues (Walther, 2011; van der Land, Schouten, Feldberg, Huysman & van den Hooff, 2013).

Previous research on emoji and emoticons

Research has started to explore the usage of emoji and emoticons in communication. As emoji are being used more, people have decreased their usage of emoticons. After all, emoji have more influence than emoticons do on the perception of the message that is communicated (Pavalanthan & Eisenstein, 2015; Ganster, Eimler & Nicole, 2012). However, emoji have the same linguistic functions as emoticons, namely the following: 1) to express emotions, mapped directly onto facial expressions, 2) as non-emotional meanings, mapped conventionally onto facial expressions, and 3) as indications of illocutionary forces that do not map conventionally onto facial

expressions (Austin, 1975 as cited in Pavalanthan & Eisenstein, 2015). Additionally, the inclusion of emoticons results in better comprehension of sarcastic comments in CMC compared with sentences with no emoticons, and they influence the interpretations of the sentences (Filik, Turcan, Thompson, Harvey, Davies & Turner, 2016). It is yet unclear whether the addition of emoticons improves the comprehension of a sentence, as findings conflict (Aldunate & Gonzalez-Ibanez, 2017; Lo, 2008). Emoji might have the same power as emoticons do when it comes to increasing the comprehension of written texts. They might be used as substitutes for words or even whole sentences (Denasi, 2017). Radford and colleagues (2016) experimented with emoji by translating the whole story of *Moby Dick* into emoji. They stated that most emoji represent nouns, and only a few emoji could be used as verbs, concluding that emoji are "a rapidly evolving and increasingly important mode of communication which is complementary to text" (Radford et al., 2016: 4).

Previous research on substitution

To process a sentence, the meanings of the words in the sentence must be retrieved and combined. What happens when modalities other than words are substituted in sentences? A substitute can be seen as an expression from one modality placed into the grammar of another modality (Cohn, 2016). The substitution could be a visual such as a picture used as a substitute for a word in a sentence. Take, for example, the following sentence:

John loves to eat  *every Friday*.

Here, the word 'pizza' is substituted by the pizza emoji, so the visual image is placed into the grammar of another modality, a sentence with words. Only some previous research on the substitution of images for words in sentences has been done. These types of substitutions into sentences are prevalent in the 'I ♥ New York' type of construction (Cohn, 2013b). Visual substitutions also appear in 'rebus' sentences, where one or more words are substituted by visuals (Potter, Kroll, Yachzel, Carpenter & Sherman, 1986; Cohn, 2016).

Potter and colleagues (1986) were the first to explore these types of interactions in sentence processing. They suggested that to understand a sentence, the meaning of the words must be retrieved and combined, and thus, pictures should be harder to understand in a sentence. On their own, words were comprehended more quickly than pictures were, but words and pictures were understood equally fast (Potter at al., 1986). Research looking at brain responses to congruous and

incongruous images in the context of a sentence showed that they were both harder to process compared with sentences without images, but both images were processed similarly to words (Ganis, Kutas & Sereno, 1996; Nigam, Hoffman & Simons, 1992). An example of a sentence from the experiment of Nigam et al. (1992: 17) is "I can never find a matching pair of socks" where the word 'socks' was substituted into an image of 'socks' (congruous) or a 'flute' (incongruous). Other researchers found that substituted images and words are processed with similar brain responses (Federmeier & Kutas, 2001; Nigam et al., 1992).

This work has primarily focused on the processing of noun substitutions, not verb substitutions. Potter et al. (1986) speculated that nouns can be successfully substituted by images within or at the end of a sentence without causing the original meaning of the sentence to be lost, but the substitution of other words, such as verbs, would be more difficult than that of nouns, as verbs may be more difficult to visualize and depict. Given this prior work involving substituting images for nouns, would the outcome be different for verbs?

The differences between nouns and verbs

A well-known statement about communication is that a picture says a thousand words, and the increasing popularity of emoji shows us that our communication extends beyond merely words (Cohn, 2015). The increasing popularity of emoji—92% of internet users used them in 2016, 777% more marketing campaigns used emoji than in 2015 (Tao, 2016); and 'emoji suggestions' are popular today in online messaging programs (Apple, WhatsApp)—shows us the increasing ease and opportunities for people to use emoji in their communication. Previous qualitative research on the motivations for the usage of emoji showed that a small number of emoji were used as text replacements, by replacing one word of a sentence or a complete sentence with an emoji (Cramer, De Juan & Tetreault, 2016). Cramer et al. (2016) showed in their qualitative research that some people used emoji as text replacement. The social and linguistic function of emoji are complex and varied, and supporting emoji can ease conversational functions more than fun alone (Cramer et al., 2016). They did not examine the differences between noun and verb replacements with emoji. Nevertheless, the substitution of pictures for nouns within or at the ends of sentences appears to incur some processing costs (Ganis et al., 1996; Nigam et al., 1992; Potter et al., 1986). Little is known about the substitution of verbs. However, familiar verb substitutions also exist—for example the 'I ♥ New York' constructions—which shows us that people already replace verbs with pictures. Nonetheless, the speculation is that the substitution of

images for verbs is more difficult than that for nouns, because any picture of an action is a picture of one or more objects (Potter et al. 1986). Mihalcea and Leong (2008) conducted an experiment with pictorial substitutions for multiple words and did not find differences in substitution between nouns and verbs. However, they substituted more words than just nouns and verbs, so that made it more difficult to compare them specifically.

According to Vigliocco et al. (2010), verbs impose greater processing demands than nouns do, because verbs refer to events and typical nouns refer to objects. Verbs are also more complex than nouns are (Gentner, 1982; Vigliocco et al., 2010). Children learn nouns before they learn verbs because the words refer to objects, e.g., 'daddy' or 'dog' (Genter, 1982) and are easier to comprehend (Goldin-Meadow, Seligman & Gelman, 1976). Verbs might be more challenging because they are more linked to other words. Nouns can more easily stand alone, but verbs "license" other words. For example, "love" licenses a subject and an object: 'X' loves 'Y'. The verb itself encodes this "argument structure" (Jackendoff, 1972, 1992), which an image may not have intrinsically. The heart may not call up the need for subjects or objects in the same way, and thus might be hypothesized as harder to process. This is consistent with findings that verbs depend on other words for the processing of the sentence (Ferreira & Henderson, 1990). A noun is related to a thing and can be shown in singular or plural form, but a verb is a part of an event, and is dependent of the other words in the sentence, and can be shown in different tenses (Baker, 2003) which results in harder processing. The theory above about the harder processing of the verb in contrast to the noun raises an interesting question regarding multimodality: *how might substituting emoji for nouns and verbs influence the processing of the sentence?*

Self-paced reading

One way to study the processing of emoji substituted into sentences is to measure self-paced-reading (SPR) times. The self-paced-reading method was invented in the 1970s and involves asking participants to read a sentence word by word (Aaronson & Scarborough, 1976; Mitchell & Green, 1978 as cited in Jegerski, 2014) by clicking a button to view each next word in the sentence. The amount of time participants that take to read each word of the sentence are recorded, and are used as indicators of their processing effort (Jegerski, 2014). Previous research involving SPR that compared grammatical and ungrammatical nouns and verbs (singular vs. plural) showed faster reading times for sentences with only grammatical singular words than those with plural words or both (singular and plural), with better comprehension found for congruous grammatical words

(Pearlmutter, Garnsey and Bock, 1999). SPR has been used in psycholinguistics to target the comprehension of anomalies, including specific grammar violations. Jegerski (2014) showed the stimuli with grammar violations induce longer reading times at or after the point of the violation, as in number agreement violations (Foote, 2011 as cited in Jegerski, 2014).

The current study

Previous work has shown that images can be used as substitutions for nouns without causing the meaning of the sentence to be lost (Potter et al., 1986), and sentences with anomalous pictures were more difficult to process than sentences with anomalous words (Nigam et al., 1992; Ganis et al., 1996). However, not much research has been done on the substitution of verbs. This study was the first to explore substitutions with both nouns and verbs, the first with the substitutions of emoji, and the first to measure reading times for these types of interactions. Previous research mostly focused on the substitution of noun images at the ends of sentences. The current study expands on these findings to find out whether the substitution of emoji into a sentence, placed as verbs or nouns, influences the processing of the sentence.

For this experiment, the influence of the position (verb or noun) in the sentence was measured in combination with the type of substitution (no substitution, normal substitution and switched substitution). This resulted in five types of sentences:

No substitution – no substitution in a sentence; the noun and verb are normal words

Normal noun substitution – the emoji-substitution for a noun in a sentence, in the expected noun position

Normal verb substitution – the emoji- substitution for a verb in a sentence, in an expected verb position

Switched noun substitution – the emoji-substitution for a verb in a sentence, which is equal to the meaning of a noun in the sentence, so a noun-emoji is placed in an unexpected position of the verb.

Switched verb substitution – the emoji-substitution for a noun in a sentence, which is equal to the meaning of a verb in the sentence, so a verb-emoji is placed in an unexpected position of the noun.

The influence of the substitution of emoji on the processing of a sentence was examined by measuring the SPR times for each word of the sentence. Participants' recognition of the substitution was measured by asking what word was substituted. Comprehension was measured

with ratings of the sentences' understandability. These three variables were combined to find out how well the participants comprehended the sentences. The fourth variable measured was perceived fun, again measured through ratings.

First, we hypothesized about the differences between the sentences with and without substitutions:

H1 *– Sentences with emoji substitutions will be harder to comprehend than sentences with normal words.*

It was expected that the sentences with no substitutions would result in the fastest reading times. In addition, the comprehension ratings for sentences with no substitutions would be higher than those for sentences with emoji substitutions. This hypothesis was based on the findings of Potter et al. (1986) that 'rebus' sentences took longer to read than regular sentences. The comprehension of the sentences with substitutions was expected to be harder than that of sentences with normal words, as the substitutions would not be expected in the sentences.

Second, the position of a substitution in a sentence was expected play a role:

H2 *–An emoji substitution placed in the verb position in a sentence will be harder to comprehend than when an emoji is placed in the noun position, as verbs will be harder to comprehend than nouns will be.*

Emoji substituted for verbs were predicted to be harder to comprehend compared with those substituted for nouns. This hypothesis was based on previous research that stated that images can be used as substitutions for nouns, and the speculation that verbs are more difficult to substitute by images than nouns (Potter et al., 1986). In addition, the familiarity of noun emoji was expected to be higher for participants because the number of emoji that can be used as verbs is lower than that for nouns (Radford et al., 2016).

Third, differences were expected between normal and switched emoji substitutions:

H3 – *Emoji substitutions placed in unexpected positions (switched nouns and verbs) in a sentence will be harder to comprehend compared with emoji substitutions placed in the expected positions (normal nouns and verbs) in a sentence.*

Units in sentences with switched substitutions consider grammar violations, and were expected to result in longer reading times compared with the sentences with normal substitutions based on Jegerski (2014). In addition, the ratings for comprehension and accuracy for normal substitutions

would be much higher than those for switched substitutions. This was based on Potter et al. (1986) who stated that images can be used as substitutions for words without causing the meaning of the sentence to be lost, but Potter et al. (1986) substituted images only in congruent positions. In this study, normal substitutions were expected to be more useful substitutions than switched substitutions would be.

Fourth, the types and positions of substitutions should interact:

H4a *– Emoji substitutions placed in the expected positions in a sentence will be the easiest to comprehend when in the noun rather than the verb positions.*

H4b *– Emoji substitution placed in unexpected positions in a sentence will be the hardest to comprehend when in the noun rather than the verb positions.*

Normal noun and verb substitution were expected to result in shorter reading times and higher comprehension ratings compared with switched substitutions. The studies of Nigam et al. (1992) and Ganis et al. (1996) found differences between the processing of congruous and incongruous substituted images. In the current study, switched substitutions were expected to be considered incongruous images (Nigam et al., 1992; Ganis et al., 1996), because a noun or verb emoji would be placed in an unexpected position (i.e., noun as verb and verb as noun). Therefore, the expectation was that switched substitutions would be more difficult to read and comprehend than normal substitutions because switches are predicted to be a type of grammar violation (Jegerski, 2014). In addition, switched emoji in noun positions were expected to be harder to comprehend than switched emoji in verb positions. This was because verbs are more complex than nouns are (Vigliocco et al., 2010; Gentner, 1982). Verbs are linked more to other words in sentences, whereas nouns can stand on their own (Jackendoff, 1972, 1992). The processing of a sentence with verbs is more difficult than that with nouns, as nouns are easier to comprehend (Goldin-Meadow, Seligman & Gelman, 1976). Finally, the type of substitution is predicted to have more influence on the comprehension and reading time than on the position. Thus, it is expected that switched verb substitutions (a verb emoji placed as a noun) would result in shorter reading times than switched noun substitutions would be (a noun emoji placed as a verb).

Fifth, perceived fun was measured to find out if harder comprehension would lead to more enjoyability:

H5 *– People like it more when a sentence is harder to comprehend, so emoji substitutions placed in the expected positions (normal nouns and verbs) will be liked more than a sentence with normal words, but emoji placed in unexpected positions (switched nouns and verbs), despite the harder comprehension will not be liked more.*

It was expected that a participant would perceive a harder-to-comprehend sentence as more fun. In addition, sentences with normal emoji substitutions would be perceived as more fun than those with no substitutions, due to the addition of emoji. People like emoji on their own, which would increase the perceived fun of the sentences with normal emoji (Shaul, 2015). Furthermore, normal substitutions would be perceived as more fun than sentences with no substitutions would be, due to the longer expected reading time, harder comprehension ratings and higher perceived-fun ratings. A longer reading time should lead to more fun because when one needs more time to process something, one will like it more (Giora, Fein, Kronrod, Elnatan, Shuval & Zur, 2004). However, switched substitutions would be harder to comprehend compared with normal and no substitutions, but they would not be perceived as more fun. Despite the longer reading time, and the harder comprehension, the expected perceived fun will be lower, because the participants would understand that the sentence was wrong or weird (Nigam et al., 1992; Ganis et al., 1996). This hypothesis was an addition to distinguish the relation between comprehension and perceived fun.

Table 1. *Predictions of the conditions for the dependent variables*

Predictions				
Reading time	**NE<NN**	**NN<NV**	**NV<SN**	**SN>SV**
Accuracy ratings	**N/A**	**NN>NV**	**NV>SN**	**SN<SV**
Perceived-fun ratings	**NE<NN**	**NN>NV**	**NV>SN**	**SN<SV**
Comprehension ratings	**NE=NN**	**NN=NV**	**NV>SN**	**SN<SV**

* The conditions are abbreviated as: NE (No Emoji sentence), NN (Normal Noun substitution), NV (Normal Verb substitution), SN (Switched Noun substitution), and SV (Switched Verb substitution).

Table 1 summarizes these predictions for the conditions based on the hypotheses. Overall, no substitutions were predicted to be comprehended the easiest, followed by normal noun substitutions, normal verb substitutions, and then switched noun and switched verb substitutions.

METHOD

Stimuli

For the experiment, 32 unique sentences were created, which were manipulated into the experimental conditions. Examples for each condition used in this study are shown in Table 2. Additional fillers, including emoji at the ends of sentences and with logos, were included to distract the participants from the experimental manipulation.

Condition 1: *sentences without substitutions*
Condition 2: *sentences with nouns substituted by a correct emoji*
Condition 3: *sentences with verbs substituted by a correct emoji*
Condition 4: *sentences with nouns substituted by an incorrect emoji*
Condition 5: *sentences with verbs substituted by an incorrect emoji*

Table 2. *Examples of the sentences used in the experiment*

	No Emoji	**Normal**	**Switched**
Noun	John loves eating pizza every Friday.	John loves eating 🍕 every Friday.	John 🍕 eating pizza every Friday.
Verb	John loves eating pizza every Friday.	John ❤️ eating pizza every Friday.	John loves eating ❤️ every Friday.

The stimuli were divided into four counterbalanced lists in a Latin square design such that each participant saw one sentence from each scenario, but across the participants, all conditions of a scenario were viewed. Each participant viewed a random order of stimuli of his or her list.

All of the sentences used for the experiment can be found in Appendix B. The sentences were designed to be simple, not difficult to read, and with no difficult words, based on the study by Mihalcea and Leong (2008). The sentences were written in the present simple tense, and were based on the possible emoji vocabulary set. The emoji of iOS were used because these are the most detailed emoji and are available for all mobile operating systems (e.g., they can be downloaded on Android). The canonical meanings of the emoji were used to determine their international definitions (Emojipedia, 2017).

Participants

In total, 72 participants (41 male, 31 female) filled out the experimental survey. Only participants who filled out the survey completely were taken into account, which means that one participant was excluded due to survey incompletion. The mean age of the participants was 26.8 (*SD=10.20*, range: 17 – 62). Furthermore, 31 participants (43.06%) had a master's degree, 30 participants (41.67%) had a bachelor's degree, and 11 participants (15.28%) had completed only high school. The participants were recruited via convenience sampling and were approached by means of social media, WhatsApp, and email.

Table 3. *Mean scores (seven point Likert scale) of the end questions of the experiment (N=72)*

Subject (SD)	Mean	Mean men	Mean women	Mean <35y	Mean >35y
Level of English	5.50 (1.32)	5.61 (1.12)	5.35 (1.56)	5.63 (1.32)	4.50 (.93)
App usage	6.44 (.90)	6.54 (.90)	6.32 (.91)	6.47 (.93)	6.35 (.71)
Emoji usage	4.97 (1.23)	4.71 (1.37)	5.32 (.95)	4.89 (1.06)	5.63 (1.24)
Emoji familiarity	5.78 (1.05)	5.68 (1.08)	5.90 (1.01)	5.91 (.96)	4.75 (1.28)
Emoji replacing	2.60 (1.40)	2.54 (1.43)	2.68 (1.38)	2.48 (1.39)	3.50 (1.20)
Likability of others usage	4.85 (1.58)	4.54 (1.75)	5.26 (1.24)	4.84 (1.64)	4.88 (1.13)

In Table 3, general findings regarding the participants are shown. Women reported using more emoji than men did, t (70) = 2.15, $p < .05$. Likability of emoji did not differ between genders, t (70) = 1.96, $p = .054$. Younger participants were more familiar with emoji than older participants were, t (70) = 3.11, $p < .005$. In addition, not many participants reported replacing words with emoji. The levels of English of the participants were relatively high, although most of the participants were native Dutch, not English, speakers.

Procedures

The experiment was presented using the online survey software program Qualtrics, by using a JavaScript plugin to measure the reading times for the SPR task. Participants were able to do the experiment using a desktop computer.

First, the participant were thanked for participating in the online experiment, and shown brief instructions for the experiment. They gave consent for their participation before starting the experiment. Trials began with a screen reading "Ready" and then the sentences were shown word by word with the SPR method (Jegerski, 2014), centered on the screen. Participants clicked on a button to start each sentence and to progress from word to word.

After each sentence, participants rated how understandable and enjoyable the sentence was. The enjoyability scale was assessed with a seven-point Likert-scale (1 = not enjoyable / 7 = very enjoyable) based on the study by Giora et al. (2004). The understandability/comprehension question was measured with the seven-point Likert-scale (1 = not understandable / 7 = very understandable) according to the research of Walther and D'addorio (2001). Finally, after each sentence, participants were asked to fill in what they thought the word substituted by the emoji was in an empty text box.

When the participants had finished the 32 sentences, they were asked to answer questions about their backgrounds (see Participants). Questions about the familiarity with and the use of emoji were asked to gather general information about the participants related to emoji: how often they used emoji; and if they replaced words with emoji (1 = never / 7 = every message); if they liked it when other people used emoji in their messages to them (1 = not at all / 7 = very much); and how familiar they were with these emoji (1 = not familiar / 7 = very familiar). The participants were also asked about their smartphone operating system (iOS / Android / Windows or other) and usage of message apps provided with the seven-point Likert-scale (1 = never / 7 = always). The questionnaire ended with four demographic questions, which provided information about their age, gender, and English and education levels. All of the questions on the experimental survey can be found in Appendix C.

Data analysis

All items were averaged across each participant for the subject analysis per condition. For reading time, the SPR task was used to measure the time the participants took to read every word of the sentence, and the reading time per condition per participant was averaged. Outlier removal was completed for all reading times over 2.5 times the standard deviation from the mean, and all reading times under 300 milliseconds per word. In total, roughly 2% of the data were discarded. Reading times were analyzed using a 3 (type substitution: no substitution / normal emoji substitution / switched emoji substitution) x 2 (position in sentence: as verb or noun) repeated-

measures ANOVA, with pairwise comparisons reported for post-hoc tests using a Bonferroni correction. An additional paired samples t-test was used to examine sentences with and with no substitutions.

The ratings for post-sentence questions were used to analyze the understandability and enjoyability of the sentence. Ratings were averaged per condition across participants. The ratings for comprehension were assessed using a paired samples t-test, to compare the mean scores between the categories of no substitution- and emoji substitution to find support for hypothesis 1. A 2 (type of substitution: normal and switched) x 2 (position: verb and noun) repeated-measures ANOVA was conducted to compare substitution conditions (hypotheses 2, 3 and 4). The ratings for perceived fun were analyzed using a three level repeated-measures ANOVA comparing the mean ratings for no, normal and switched substitutions (hypothesis 5).

Finally, participants' responses to the post-sentence fill-in-the-blank questions were coded for whether they accurately recognized which words were substituted by emoji. The codebook with the emoji meanings can be found in Appendix D. The codebook was developed to check whether participants' answers were in line with the correct meanings of the emoji. Correct meanings were coded with '1'. If the answer was inaccurate but related to the correct answer or suited the sentence and was grammatically correct, the answer was coded '0.5'. Incorrect answers were coded '0'. Accuracy ratings were analyzed by using a 2 (type of substitution: normal and switched) x 2 (position: verb and noun) repeated-measures ANOVA (hypotheses 2, 3, and 4).

RESULTS

Reading time

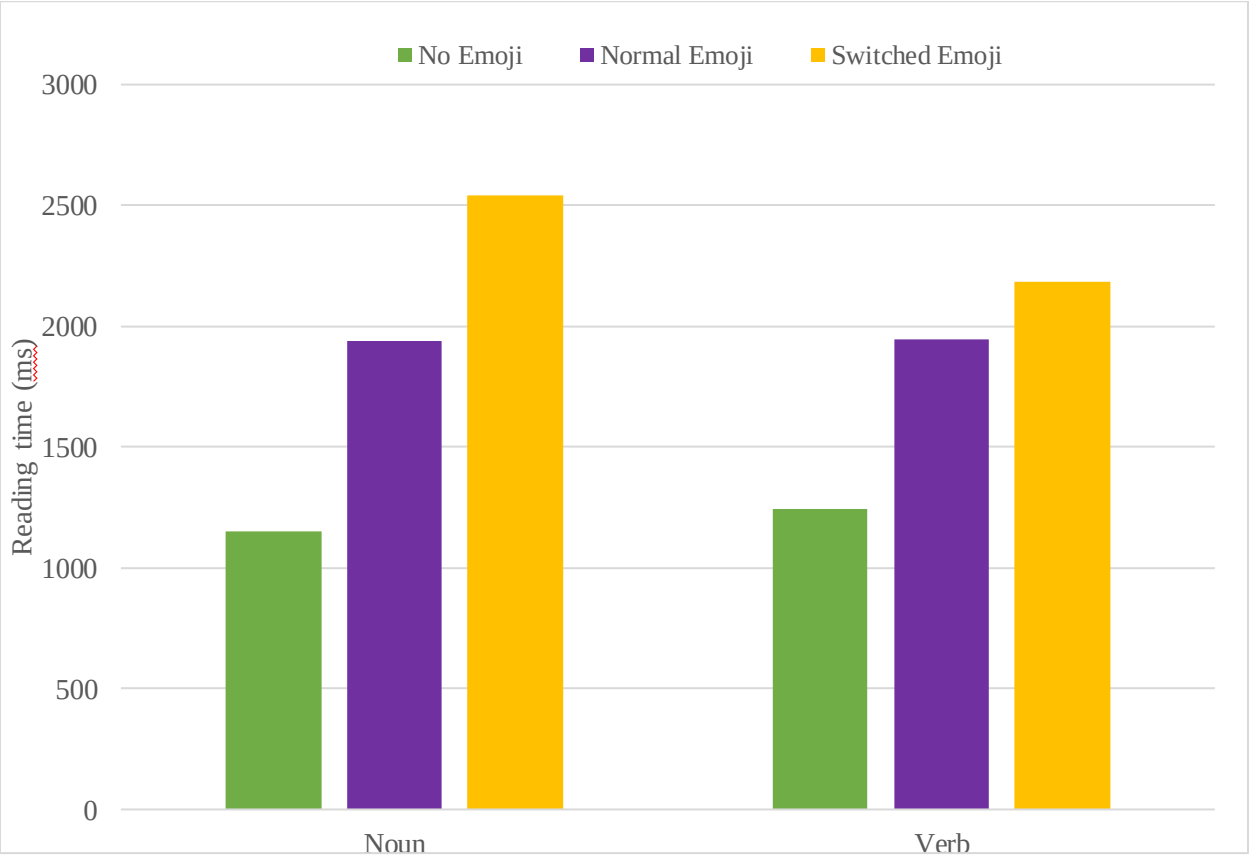

Figure 4. *Mean scores for reading time (in milliseconds)*

A paired samples t-test showed a significant effect for type; the condition for no substitution resulted in shorter reading times than the substitution condition, t (71) = 13.54, p < .001.

When including positions in the analysis of reading times, a significant main effect appeared for type of substitution, F (1.8, 134.2) = 107.29, p < .001, partial η^2 = .60, ε = .946 (degrees of freedom corrected with the Huynh-Feldt [1976] estimates for sphericity). The mean scores for reading time are shown in Figure 4. The main effect of type occurred because no substitutions had a significantly shorter reading time than the normal substitutions, (p < .001), and normal substitutions had a significantly shorter reading time than the switched substitution, (p < .001).

No main effect was found for position, F (1, 71) = 2.01, p = .16. However, a significant interaction appeared between emoji type and position: F (1.8, 125.9) = 6.30, p < .005, partial η^2

= .08, ε = .946 (degrees of freedom corrected with the Huynh-Feldt [1976] estimates for sphericity). This arose because no substitutions were read faster than switched substitutions (p <.005), but no difference occurred between no substitutions and normal substitutions (p = .44).

Comprehension

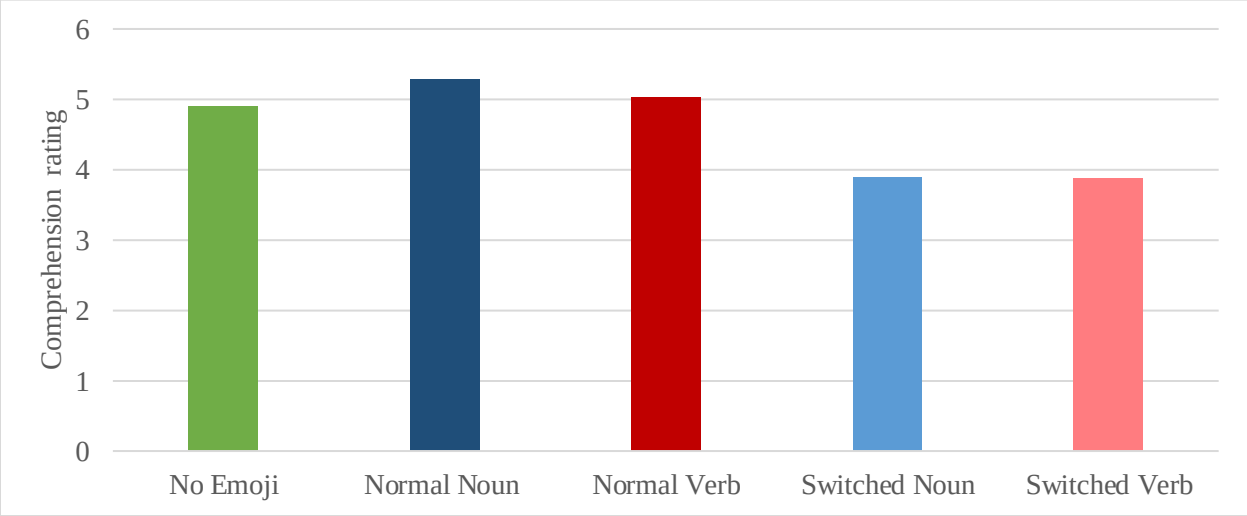

Figure 5. *Mean ratings for comprehension (seven-point Likert-scale)*

A paired samples t-test showed a significant effect for type: No substitution yielded a higher rating for comprehension than the substitution condition, t (71) = 2.30, p < .05. A 2 (type) x 2 (position) repeated-measures ANOVA showed a main effect of substitution type, F (1, 71) = 127.24, p < .001, arising because sentences with normal substitutions were rated as significantly more comprehensible than those with switched substitutions. The mean ratings for comprehension are shown in Figure 5. There was no main effect of position, F (1, 71) = 3.24, p = .08 partial η^2 = .04, nor was a significant interaction effect found between position and emoji, F (1, 71) = 2.40, p = .13 partial η^2 = .03.

Perceived fun

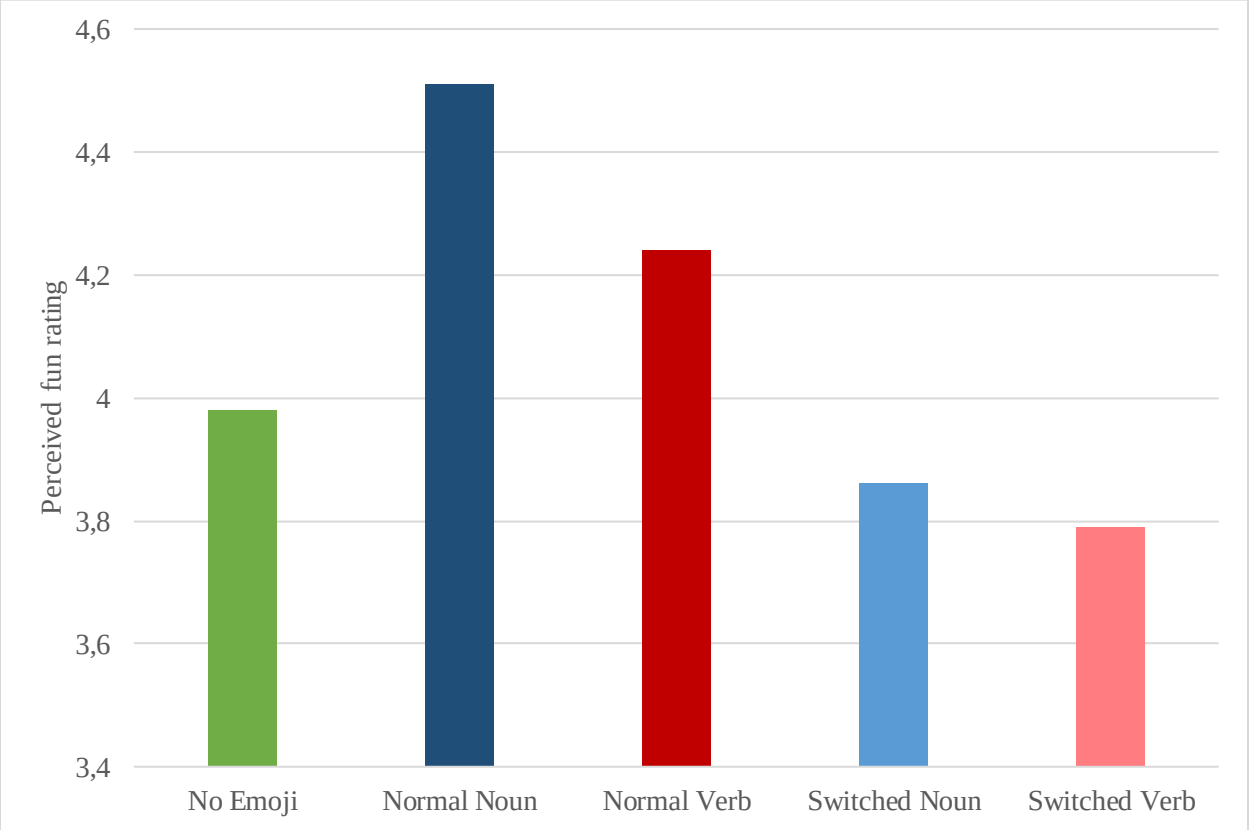

Figure 6. *Mean ratings for Perceived Fun (7-point Likert-scale)*

In the analysis of ratings for perceived fun, a significant main effect appeared for type of emoji, F (1.714, 121.713) = 14.02, $p < .001$, $\varepsilon = .857$ (degrees of freedom corrected with the Huynh-Feldt [1976] estimates for sphericity). This arose because the normal substitutions were perceived as more fun than no substitutions ($p < .005$), and/or switched substitutions ($p < .001$). No significant difference was found between no and switched substitutions ($p = .59$). In Figure 6 the mean ratings for perceived fun are shown.

Accuracy

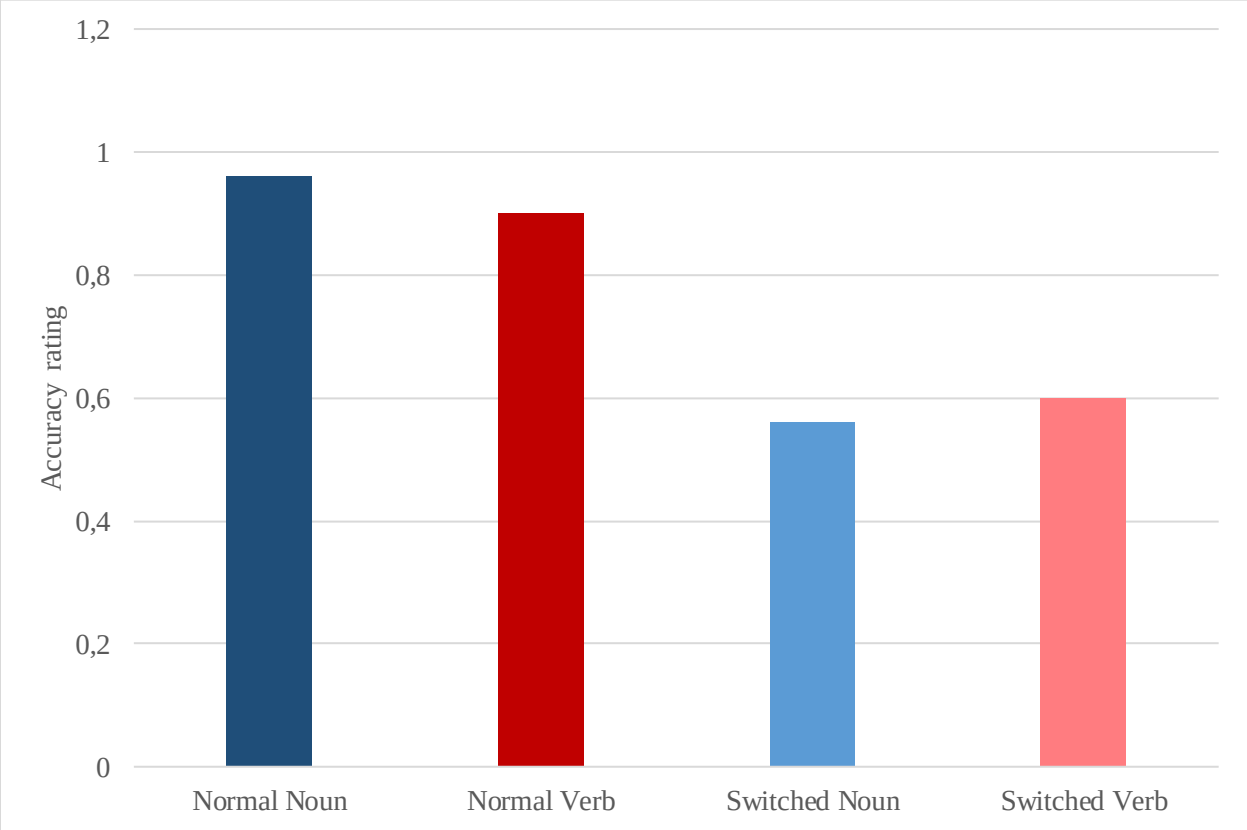

Figure 7. *Mean ratings for accuracy (1 = most accurate)*

Finally, the participants' accuracy in recognizing the substituted words was assessed. A main effect of substitution type, F (1, 71) = 104.14, p < .001 partial η^2 = .60, arose because the normal substitutions were recognized more often than the switched substitutions (Figure 7). A significant main effect on position for accuracy, F (1, 71) = 4.90, p < .05 partial η^2 = .07 was also observed, substituted words in noun positions were more accurately recognized than those in verb position. No interaction was found between position and type on accuracy, F (1, 71) = .33, p = .57 partial η^2 = .01.

DISCUSSION

This thesis posed the following question: *What is the influence that the substitution of emoji for nouns and verbs has on the processing of a sentence?* Overall, people comprehended sentences with no emoji better than they did sentences with emoji, and emoji in unexpected position were harder to comprehend than emoji in the expected positions. People perceived sentences with emoji as more fun when the emoji were placed at the expected positions compared with sentences with

emoji in unexpected positions or with no emoji. Below these results will be discussed in light of the hypotheses and their broader implications.

Substitutions vs. no substitutions

The first hypothesis posited that ***(H1)*** *sentences with emoji substitutions will be harder to comprehend compared with sentences with normal words.* This was supported by findings that sentences with no substitutions resulted in significantly shorter reading times and higher comprehension ratings than did sentences with substitutions. This means that sentences with emoji substitutions were harder to comprehend than sentences with normal words. This was reinforced by the comprehension ratings, which indicated that sentences with and without substitutions can both be described as understandable, despite the (few) differences between them. These findings are in line with Potter et al. (1986), who stated that 'rebus' sentences took longer to read than all-word sentences. An explanation for these findings is that the sentences with normal words are more familiar for people than sentences with substitutions. Therefore, people might read sentences with normal words more quickly and comprehend them better than they would sentences with emoji substitutions.

Nouns vs. verbs

The second hypothesis proposed differences between grammatical categories, stating that ***(H2)*** *an emoji substitution placed in the verb position in a sentence will be harder to comprehend than when an emoji is placed in the noun position, as verbs will be harder to comprehend than nouns.* This hypothesis was not supported. Reading times revealed no differences for emoji substitutions between positions on their own, although an interaction was found between position and type (see below). No differences arose between positions in terms of the ratings of comprehension either. However, participants were more accurate in recognizing substituted words in noun positions than in verb positions. The speculation of Potter et al. (1986) that verbs might be more difficult to substitute than nouns is not supported with the findings of this study. Both nouns and verbs appear to be substitutable by emoji in sentences, but nouns may be more accurately recognized than verbs. In addition, despite the differences in complexity and structure between nouns and verbs discussed in prior studies (Gentner, 1982; Goldin-Meadow, Seligman & Gelman, 1976; Jackendoff, 1972, 1992; Vigliocco et al., 2010), these differences did not modulate how nouns and verb were processed and rated.

Furthermore, the findings showed that differences in argument structure (Jackendoff, 1972, 1992) did not factor into how people read and comprehended the emoji. No differences were found. Both nouns and verbs were comprehended equally well due to the surrounding context of the other words. Even though nouns can stand alone and verbs license other words, the other words of the sentence also had an influence on the noun substitutions, as they made it easier for the participants to comprehend what was being communicated in both cases. Thus, it appears that few differences exist between the substitution of emoji in noun and verb positions.

Switched substitutions vs. normal substitutions

The third hypothesis (***H3***) posited that *emoji substitutions placed in unexpected positions (switched nouns and verbs) in a sentence will be harder to comprehend compared with the emoji substitutions placed in the expected positions (normal nouns and verbs) in a sentence.* Support for this hypothesis appeared in findings that emoji placed in the expected positions resulted in significantly shorter reading times than emoji that switched positions (i.e., noun as verb and verb as noun). This suggests that switches are recognized as a type of "grammatical violation", and the slower reading times are in line with grammatical violations found in other self-paced reading studies of sentences (Jegerski, 2014). Also, comprehension ratings suggested that emoji in the expected position were understandable (greater than the midpoint of 4 of 7), but substitutions in unexpected positions were not. Finally, substituted words for normal emoji substitutions were more accurately recognized than switched substitutions.

Additionally, hypothesis 3 was based on the theory that nouns could be substituted by normal images (Ganis et al., 1996; Nigam et al., 1992; Potter et al., 1986), but that switched images would be incongruous when used as substitutions for nouns (Ganis et al., 1996; Nigam et al., 1992). This expected difference was supported due to the longer reading times and lower comprehension ratings for unexpected emoji substitutions. The difference between switched and expected emoji implies that some emoji are better in different roles in a sentence. Some are more appropriate in the noun position, and some are more appropriate in the verb position. These optimal positions may occur due to the semantics (the meaning) of the emoji. If nouns are typically objects, and if certain emoji represent objects, they may be more optimal as nouns. Similarly, if verbs are more typically events, and if certain emoji are more depictive of events, they should be better as verbs. Thus, when one switches these positions the comprehension will be harder.

Type vs. position

The fourth hypothesis posited that an interaction would exist between position and type of substitution, specifically: ***(H4a)*** *emoji substitutions placed in the expected positions in a sentence will be the easiest to comprehend when in the noun rather than the verb positions,* and ***(H4b)*** *emoji substitutions placed in unexpected positions in a sentence will be the hardest to comprehend when in the noun rather than the verb positions.*

For hypothesis 4a, partial support was found, but for hypothesis 4b no support was found. Reading times showed that the noun versus verb position was modulated by the type of emoji. Specifically, an emoji substitution placed in an unexpected position as a verb (i.e., noun as verb) resulted in a shorter reading time compared with noun (i.e. verb as noun). No significant interactions between type and position were found in terms of comprehension and accuracy. These findings partially supported hypothesis 4a but not 4b.

These results imply that emoji substitutions placed in the expected positions are more acceptable as substitutions than those in unexpected positions, but this can be modulated by the specific type of emoji. These findings expand on previous studies that showed that incongruous image substitutions were harder to understand than congruous substitutions (Ganis et al., 1996; Nigam et al., 1992), and are in line with findings grammar violations induce longer reading times (Jegerski, 2014).

Perceived fun

Finally, the hypothesis about perceived fun was that ***(H5)*** *people like it more when a sentence is harder to comprehend, so emoji substitutions placed in the expected position (normal nouns and verbs) will be liked more than a sentence with normal words, but emoji placed in unexpected positions (switched nouns and verbs) despite the harder comprehension will be less liked.* Ratings for both comprehension and perceived fun supported this hypothesis. First, sentences with substitutions were harder to comprehend than sentences with no substitutions, which supported hypothesis 1. Longer reading time and harder comprehension are hypothesized as leading to more fun (Giora et al., 2004) due to the more intensive process. This was indeed supported, as sentences with substitutions were perceived as more fun than sentences with no substitutions. However, the switched substitutions were the hardest to comprehend, but were perceived as less fun compared with normal substitutions. Normal substitutions were rated as somewhat fun, and no substitutions and switched substitutions had lower-than-neutral fun ratings, which is more in the direction of

not fun. An explanation for the higher rating of perceived fun for normal substitutions might be that the emoji were perceived as more fun on their own. In contrast, sentences with normal words were probably perceived as too simple and therefore as less fun, and switched substitutions might be perceived as more difficult or incongruous, and thus less fun.

Implications

This study was an expansion of previous research (Ganis et al., 1996; Nigam et al., 1992; Potter et al., 1986) on the substitution of images for words. This study was the first to compare the substitution of both nouns and verbs in word-by-word processing and switching their positions instead of only a congruous or incongruous noun within or at the end of the sentence as in previous research (Ganis et al., 1996; Nigam et al., 1992; Potter et al., 1986). The theoretical implication for the type of substitution is that emoji can be used as substitutions for nouns and verbs. Based on the findings for the positions, the theoretical implication is that verbs can also be substituted by images, such as emoji, and the sentence will be comprehended well. This goes against Potter et al.'s (1986) speculation that verbs are more difficult to substitute. However, emoji cannot be placed in any position, as switched substitutions were more difficult than normal emoji substitutions. This revealed that switched substitutions were difficult for the participants to comprehend and appeared to be incongruous (Ganis et al., 1996; Nigam et al., 1992; Potter et al., 1986). Finally, emoji lead to more fun, but only for those placed in the expected positions.

For CMC models, emoji can be used as visual cues for enhancing online communication due to the lack of non-verbal cues available (Walther, 1992). The expectation that emoji as visual cues substitute for nonverbal cues was not measured with this study. However, the findings of this study showed that emoji are comprehended very well as substitutions for nouns or verbs in sentences and could help the users of CMC to develop interpersonal relationships. The use of emoji as substitutions for nouns or verbs in CMC could influence the frequency of friendly/romantic relationships in a positive way and could to improve the structuring thoughts of according to the SIP theory by Walther (2011).

Different modalities are hypothesized as sharing a common conceptual structure (meaning), which is reflected in the similar brain responses to substitutions in previous studies (Ganis et al., 1996; Nigam et al., 1992; Potter et al., 1986). However, different modalities have their own grammar (Cohn, 2016). In this case, it is hypothesized that changing modalities is costly in terms of the processing of a substitution (slower reading time), but it can remain comprehensible due to

the shared concepts between modalities. This implies that images are not separate from a linguistic system but rather are integrated into a larger multimodal system that combines text and images (Cohn, 2013a).

Limitations and recommendations

Like any other study, this research had some limitations. To expand on the findings of this experiment a future study should take the experiment in to the lab environment. This is because the lab offers more opportunities to measure the processing of sentences with for example brain waves or eye tracking, as in previous studies with substitutions (Ganis et al., 1996; Nigam et al., 1992; Potter et al., 1986). These measurement techniques could provide more insights into the influence of an emoji's type or position in processing a sentence, as more neurocognitive information can be examined. For example with eye tracking, it is possible to show sentences with emoji all at once, and find out whether people will look more than once at the emoji and if the position of an emoji has an influence.

Although this study made the first step in investigating emoji substitutions as nouns and verbs in sentences, future research should focus on the expansion of emoji substitutions. We learned from this study that the noun and verb can be replaced by emoji, but only in the expected positions. This could test whether two or three nouns, verbs, or other sorts of words can be substituted by emoji in a sentence, as in Mihalcea and Leong (2008). For example, what about adjectives? For example, substituting adjectives such as 'new' or 'big' by emoji might be difficult.

Likewise, it remains unclear whether all of the words in a sentence could be substituted by emoji, as with the translation of the book *Moby Dick* into emoji (Radford et al., 2016). The prediction is that the whole replacement of a sentence would be different if substituted by emoji and would be limited by the number of verb emoji available compared with those for nouns (Radford et al., 2016). Furthermore, *how far can we go with the substitution of words by emoji?* At what point will people process a sentence as less comprehensible? Future research needs to determine what the limit is and whether the whole sentence can be substituted by emoji.

Conclusion

Sentences with substitutions are harder to comprehend than sentences with no substitutions are, although they are still understandable. Nouns and verbs in sentences with substitutions are both easy to comprehend, which suggests that people do not distinguish the positions of emoji

substitutions. Sentences with substitutions placed in unexpected positions are harder to comprehend those than substitutions placed in expected positions, which means that people perceive emoji as optimally used for certain types of information. The main findings of this study imply that both nouns and verbs can be replaced by emoji in a sentence with words. In addition, sentences with emoji substitutions lead to more fun. Altogether, these findings may contribute to explaining why emoji have been increasing in popularity so rapidly in multimodal communication.

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APPENDICES

Appendix A: Example sentence

An example of the images of a sentence which were shown to the participants in the experiment:

John

First screen

loves

(possible) second screen

eating

Third screen

pizza

(possible) fourth screen

every

Fifth screen

Friday

Sixth screen

(possible) second screen

(possible) fourth screen

Appendix B: Stimuli

John loves eating pizza every Friday

John loves eating ~~**pizza**~~ every friday

John ~~**loves**~~ eating pizza every friday

John ~~**pizza**~~ eating pizza every friday

John loves eating ~~**loves**~~ every friday

John loves eating ~~**Dominos**~~ every friday

John loves eating pizza every friday ~~**Dominos**~~

John loves eating pizza every friday ~~**pizza**~~

Emma writes her essays on a computer for her classes

Emma writes her essays on a ~~**computer**~~ for her classes

Emma ~~**writes**~~ her essays on a computer for her classes

Emma ~~**computer**~~ her essays on a computer for her classes

Emma writes her essays on a ~~**writes**~~ for her classes

Emma writes her essays on a ~~**Apple computer/Macbook**~~ for her classes

Emma writes her essays on a computer for her classes ~~**Apple computer/Macbook**~~

Emma writes her essays on a computer for her classes ~~**computer**~~

Aaron runs the fastest when wearing running shoes outside

Aaron runs the fastest when wearing ~~**running shoes**~~ outside

Aaron ~~**runs**~~ the fastest when wearing running shoes outside

Aaron ~~**running shoes**~~ the fastest when wearing running shoes outside

Aaron runs the fastest when wearing ~~**runs**~~ outside

Aaron runs the fastest when wearing ~~**Nike**~~ outside

Aaron runs the fastest when wearing running shoes outside ~~**Nike**~~

Aaron runs the fastest when wearing running shoes outside ~~**running shoes**~~

Julia often eats a hamburger after school

Julia often eats a ~~**hamburger**~~ after school

Julia often ~~**eats**~~ a hamburger after school

Julia often ~~**hamburger**~~ a hamburger after school

Julia often eats a ~~**eats**~~ after school

Julia often eats a ~~**Burger King**~~ after school

Julia often eats a hamburger after school ~~**Burger King**~~

Julia often eats a hamburger after school ~~**hamburger**~~

Ryan prefers ordering chicken over cooking when feeling lazy

Ryan prefers ordering ~~**chicken**~~ over cooking when feeling lazy

Ryan prefers ordering chicken over ~~**cooking**~~ when feeling lazy

Ryan prefers ordering ~~**cooking**~~ over cooking when feeling lazy

Ryan prefers ordering chicken over ~~**chicken**~~ when feeling lazy

Ryan prefers ordering ~~**KFC**~~ over cooking when feeling lazy

Ryan prefers ordering chicken over cooking when feeling lazy ~~**KFC**~~

Ryan prefers ordering chicken over cooking when feeling lazy ~~**chicken**~~

Katie sleeps badly, so she needs coffee to stay awake

Katie sleeps badly, so she needs ~~**coffee**~~ to stay awake

Katie ~~**sleeps**~~ badly, so she needs coffee to stay awake

Katie ~~**coffee**~~ badly, so she needs coffee to stay awake

Katie sleeps badly, so she needs ~~**sleeps**~~ to stay awake

Katie sleeps badly, so she needs ~~**Starbucks**~~ to stay awake

Katie sleeps badly, so she needs coffee to stay awake ~~**Starbucks**~~

Katie sleeps badly, so she needs coffee to stay awake ~~**coffee**~~

Scott likes walking through the supermarket for hours

Scott likes walking through the ~~**supermarket**~~ for hours

Scott likes ~~**walking**~~ through the supermarket for hours

Scott likes ~~**supermarket**~~ through the supermarket for hours

Scott likes walking through the ~~**walking**~~ for hours

Scott likes walking through the ~~**Albert Heijn**~~ for hours

Scott likes walking through the supermarket for hours ~~**Albert Heijn**~~

Scott likes walking through the supermarket for hours ~~**supermarket**~~

Sarah looks at his watch a lot during class

Sarah looks at his ~~**watch**~~ a lot during class

Sarah ~~**looks**~~ at his watch a lot during class

Sarah ~~**watch**~~ at his watch a lot during class

Sarah looks at his ~~**looks**~~ a lot during class

Sarah looks at his ~~**Rolex**~~ a lot during class

Sarah looks at his watch a lot during class ~~**Rolex**~~

Sarah looks at his watch a lot during class ~~**watch**~~

Colin toasts with champagne at New Years

Colin toasts with ~~**champagne**~~ at New Years

Colin ~~**toasts**~~ with champagne at New Years

Colin ~~**champagne**~~ with champagne at New Years

Colin toast with ~~**toasts**~~ at New Years

Colin toast with ~~**Moët**~~ at New Years

Colin toast with champagne at New Years ~~**Moët**~~

Colin toast with champagne at New Years ~~**Champagne**~~

Molly reads the newspaper every morning

Molly reads the ~~**newspaper**~~ every morning

Molly ~~**reads**~~ the newspaper every morning

Molly ~~**newspaper**~~ the newspaper every morning

Molly reads the ~~**reads**~~ every morning

Molly reads the ~~**AD**~~ every morning

Molly reads the newspaper every morning ~~**AD**~~

Molly reads the newspaper every morning ~~**Newspaper**~~

Nick flies by airplane to his holiday destination

Nick flies by ~~**airplane**~~ to his holiday destination

Nick ~~**flies**~~ by airplane to his holiday destination

Nick ~~**airplane**~~ by airplane to his holiday destination

Nick flies by ~~**flies**~~ to his holiday destination

Nick flies by ~~**KLM**~~ to his holiday destination

Nick flies by airplane to his holiday destination ~~**KLM**~~

Nick flies by airplane to his holiday destination ~~**Airplane**~~

Vince works out in his sports outfit for comfort

Vince works out in his ~~**sports outfit**~~ for comfort

Vince ~~**works out**~~ in his sports outfit for comfort

Vince ~~**sports outfit**~~ in his sports outfit for comfort

Vince works out in his ~~**works out**~~ for comfort

Vince works out in his ~~**Adidas**~~ for comfort

Vince works out in his sports outfit for comfort ~~**Adidas**~~

Vince works out in his sports outfit for comfort ~~**sports outfit**~~

Joyce thinks about wearing her sunglasses on this sunny day

Joyce thinks about wearing her ~~**sunglasses**~~ on this sunny day

Joyce ~~**thinks**~~ about wearing her sunglasses on this sunny day

Joyce ~~**sunglasses**~~ about wearing her sunglasses on this sunny day

Joyce thinks about wearing her ~~**thinks**~~ on this sunny day

Joyce thinks about wearing her ~~**Rayban**~~ on this sunny day

Joyce thinks about wearing sunglasses on this sunny day ~~**Rayban**~~

Joyce thinks about wearing sunglasses on this sunny day ~~**Sunglasses**~~

Lewis's opinion is that beer rocks and is delicious

Lewis's opinion is that ~~**beer**~~ rocks and is delicious

Lewis's opinion is that beer ~~**rocks**~~ and is delicious

Lewis's opinion is that beer ~~**beer**~~ and is delicious

Lewis's opinion is that ~~**rocks**~~ rocks and is delicious

Lewis's opinion is that ~~**Jupiler**~~ rocks and is delicious

Lewis's opinion is that beer rocks and is delicious ~~**Jupiler**~~

Lewis's opinion is that beer rocks and is delicious ~~**beer**~~

Carol dislikes eating bananas at lunch

Carol dislikes eating ~~**bananas**~~ at lunch

Carol ~~**dislikes**~~ eating bananas at lunch

Carol ~~**bananas**~~ eating bananas at lunch

Carol dislikes eating ~~**dislikes**~~ at lunch

Carol dislikes eating ~~**Chiquita**~~ at lunch

Carol dislikes eating bananas at lunch ~~**Chiquita**~~

Carol dislikes eating bananas at lunch ~~**Bananas**~~

Becky waves the deliverer of her French fries goodbye

Becky waves the deliverer of her ~~**French fries**~~ goodbye

Becky ~~**waves**~~ the deliverer of her French fries goodbye

Becky ~~**French fries**~~ the deliverer of her French fries goodbye

Becky waves the deliverer of her ~~**waves**~~ goodbye

Becky waves the deliverer of her ~~**McDonalds**~~ goodbye

Becky waves the deliverer of her French fries goodbye ~~**McDonalds**~~

Becky waves the deliverer of her French fries goodbye ~~**French fries**~~

Mason drove to the gas station to get some gas

Mason drove to the ~~**gas station**~~ to get some gas

Mason ~~**drove to**~~ the gas station to get some gas

Mason drove to the ~~**gas station**~~ the gas station to get some gas

Mason drove to the ~~**drove to**~~ to get some gas

Mason drove to the ~~**Shell**~~ to get some gas

Mason drove to the gas station to get some gas ~~**Shell**~~

Mason drove to the the gas station to get some gas ~~**Gas station**~~

Karen asked her father to buy car for her birthday

Karen asked her father to buy her a ~~**car**~~ for her birthday

Karen **~~asked~~** her father to buy her a car for her birthday

Karen **~~car~~** her father to buy her a car for her birthday

Karen asked her father to buy her a **~~asked~~** for her birthday

Karen asked her father to buy her a **~~BMW~~** for her birthday

Karen asked her father to buy her a car for her birthday **~~BMW~~**

Karen asked her father to buy her a car for her birthday **~~Car~~**

Jimmy walked to the station to take the train to Amsterdam

Jimmy walked to the station to take the **~~train~~** to Amsterdam

Jimmy **~~walked~~** to the station to take the train to Amsterdam

Jimmy **~~train~~** to the station to take the train to Amsterdam

Jimmy walked to the station to take the **~~walked~~** to Amsterdam

Jimmy walked to the station to take the **~~NS~~** to Amsterdam

Jimmy walked to the station to take the train to Amsterdam **~~NS~~**

Jimmy walked to the station to take the train to Amsterdam **~~Train~~**

Ellen called the bank to open a savings account

Ellen called the **~~bank~~** to open a savings account

Ellen **~~called~~** the bank to open a savings account

Ellen **~~bank~~** the bank to open a savings account

Ellen called the **~~called~~** to open a savings account

Ellen called the **~~Rabobank~~** to open a savings account

Ellen called the bank to open a savings account ~~**Rabobank**~~

Ellen called the bank to open a savings account ~~**bank**~~

Jason buys a lot of beer when going out

Jason buys a lot of ~~**beer**~~ when going out

Jason ~~**buys**~~ a lot of beer when going out

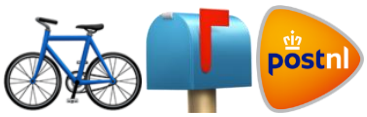
Jason ~~**beer**~~ a lot of beer when going out

Jason buys a lot of ~~**buys**~~ when going out

Jason buys a lot of ~~**Amstel**~~ when going out

Jason buys a lot of beer when going out ~~**Amstel**~~

Jason buys a lot of beer when going out ~~**beer**~~



Tommy biked to the post office to pick up his package

Tommy biked to the ~~**post office**~~ to pick up his package

Tommy ~~**biked**~~ to the post office to pick up his package

Tommy ~~**post office**~~ to the post office to pick up his package

Tommy biked to the ~~**biked**~~ to pick up his package

Tommy biked to the ~~**PostNL**~~ to pick up his package

Tommy biked to the post office to pick up his package ~~**PostNL**~~

Tommy biked to the post office to pick up his package ~~**post office**~~

Olivia danced when she received her new diamonds for Christmas

Olivia danced when she received her new ~~**diamonds**~~ for Christmas

Olivia ~~**danced**~~ when she received her new diamonds for Christmas

Olivia ~~**diamonds**~~ when she received her new diamonds for Christmas

Olivia danced when she received her new ~~**danced**~~ for Christmas

Olivia danced when she received her new ~~**Swarovski**~~ for Christmas

Olivia danced when she received her new diamonds for Christmas ~~**Swarovski**~~

Olivia danced when she received her new diamonds for Christmas ~~**Diamonds**~~

Brody was searching for a new camera for his work

Brody was searching for a new ~~**camera**~~ for his work

Brody was ~~**searching**~~ for a new camera for his work

Brody was ~~**camera**~~ for a new camera for his work

Brody was searching for a new ~~**searching**~~ for his work

Brody was searching for a new ~~**Canon**~~ for his work

Brody was searching for a new camera for his work ~~**Canon**~~

Brody was searching for a new camera for his work ~~**Camera**~~

Vicky cried a lot when her scooter was stolen

Vicky cried a lot when her ~~**scooter**~~ was stolen

Vicky ~~**cried**~~ a lot when her scooter was stolen

Vicky ~~**scooter**~~ a lot when her scooter was stolen

Vicky cried a lot when her ~~**cried**~~ was stolen

Vicky cried a lot when her ~~**vespa**~~ was stolen

Vicky cried a lot when her scooter was stolen ~~**Vespa**~~

Vicky cried a lot when her scooter was stolen ~~**Scooter**~~

Perry smelled the delicious chocolate bar he got for Valentine's day

Perry smelled the delicious ~~**chocolate bar**~~ he got for Valentine's day

Perry ~~**smelled**~~ the delicious chocolate bar he got for Valentine's day

Perry ~~**chocolate bar**~~ the delicious chocolate bar he got for Valentine's day

Perry smelled the delicious ~~**smelled**~~ he got for Valentine's day

Perry smelled the delicious ~~**Milka**~~ he got for Valentine's day

Perry smelled the delicious chocolate bar he got for Valentine's day ~~**Milka**~~

Perry smelled the delicious chocolate bar he got for Valentine's day ~~**Chocolate bar**~~

Lisa hates to eat Tacos a lot

Lisa hates to eat ~~**Tacos**~~ a lot

Lisa ~~**hates**~~ to eat Tacos a lot

Lisa ~~**Tacos**~~ to eat Tacos a lot

Lisa hates to eat ~~**hates**~~ a lot

Lisa hates to eat ~~**Taco Bell**~~ a lot

Lisa hates to eat Tacos a lot ~~**Taco Bell**~~

Lisa hates to eat Tacos a lot ~~**Tacos**~~

Tyler likes to drink a glass of whiskey before going to bed

Tyler likes to drink a ~~**glass of whiskey**~~ before going to bed

Tyler ~~**likes**~~ to drink a glass of whiskey before going to bed

Tyler ~~**glass of whiskey**~~ to drink a glass of whiskey before going to bed

Tyler likes to drink ~~**likes**~~ before going to bed

Tyler likes to drink a glass of ~~**Jack Daniels**~~ before going to bed

Tyler likes to drink a glass of whiskey before going to bed ~~**Jack Daniels**~~

Tyler likes to drink a glass of whiskey before going to bed ~~**glass of whiskey**~~

Polly smiled when she bought new jeans at the store

Polly smiled when she bought new ~~**jeans**~~ at the store

Polly ~~**smiled**~~ when she bought new jeans at the store

Polly ~~**jeans**~~ when she bought new jeans at the store

Polly smiled when she bought new ~~**smiled**~~ at the store

Polly smiled when she bought new ~~**Levi's**~~ at the store

Polly smiled when she bought new jeans at the store ~~**Levi's**~~

Polly smiled when she bought new jeans at the store ~~**jeans**~~

Helen was surfing on the internet for fun

Helen was surfing on the ~~**internet**~~ for fun

Helen was ~~**surfing**~~ on the internet for fun

Helen was ~~**internet**~~ on the internet for fun

Helen was surfing on the ~~**surfing**~~ for fun

Helen was surfing on ~~**Chrome**~~ for fun

Helen was surfing on the internet for fun ~~**Chrome**~~

Helen was surfing on the internet for fun ~~**internet**~~

Susan felt ill by smoking cigarettes when going out

Susan felt ill by smoking ~~**cigarettes**~~ when going out

Susan ~~**felt ill**~~ by smoking cigarettes when going out

Susan ~~**cigarettes**~~ by smoking cigarettes when going out

Susan felt ill by smoking ~~**felt ill**~~ when going out

Susan felt ill by smoking ~~**Marlboro**~~ when going out

Susan felt ill by smoking cigarettes when going out ~~**Marlboro**~~

Susan felt ill by smoking cigarettes when going out ~~**cigarettes**~~

Nigel listens to music with his headphones on high volume

Nigel listens to music with his ~~**headphones**~~ on high volume

Nigel ~~**listens**~~ to music with his headphones on high volume

Nigel ~~**headphones**~~ to music with his headphones on high volume

Nigel listens to music with his ~~**listens**~~ on high volume

Nigel listens to music with his ~~**Beats by Dre**~~ on high volume

Nigel listens to music with his headphones on high volume ~~**Beats by Dre**~~

Nigel listens to music with his headphones on high volume ~~**headphones**~~

Appendix C: Post and end questions of the experiment

Questions after each sentence:

How understandable 1 - 7

How enjoyable to read 1 -7

If this sentence used an image instead of a word, please type what you think that missing word is... (text box)

Demographic questions:

- Age
- Gender
- Education level
- English level

Ending questions:

How often do you use message apps (like WhatsApp)? 1 Never - 7 Always

How often do you use emojis? 1 Never - 7 Every message

How familiar are you with these emojis? 1 Not familiar – 7 very familiar

Do you replace words with emojis? 1 Never - 7 Every message

Do you like it when other people use emojis in their messages to you? 1not at all - 7 very much

What is the operating system of your smartphone? IOS - Android - Windows - Other

What emojis did you not recognize? (showing all the used emojis)

What logos did you see? (showing all the used logos)

Of which logos do you not know to what brand they belong? (showing all the used emojis)

Did you enjoy seeing logos as emojis 1 - 7

Would you use logos as emojis 1 - 7

Appendix D: Codebook

Noun Emoji	Meaning
	Pizza Pizzaslice
	Computer Computer screen
	Shoes Running shoes Sneakers Shoe
	Burger Hamburger Cheeseburger
	Beer
	Chicken Chickenwing
	Coffee Cup of Coffee
	Supermarket
	Watch
	

Clock

Champagne

Newspaper

Airplane

Shirt
Sportshirt
Tanktop

Sunglasses

Beer
Beers
Two beers

Banana

Fries
French fries
Chips

Purse
Wallet

Gas station
Gas

Car

Station
Train station
Train

Bank

Post office
mailbox
postbox
post

Diamond

Camera
Photocamera

Scooter
Vespa

Chocolat
Chocolat bar

Taco

Glass of Whiskey
Whiskey

Jeans
Pants

Internet

Cigarette

Headphone

Verb Emoji	Meaning
	loves love loved
	Writes Writing Writed
	Running Runs Run
	Eats Eat Eating
	buys buy buying
	cooks cooking cook
	Sleeps Sleeping Sleep
	walks walking walk

watch
watches
watched

toasts
toast
toasting

Reads
reading
Read

Flies
Flying
Fly

works
out
work out
worked
out

thinks
think
thinking

rocks
rocking
rock

dislikes
doesn't like
don't like

waves
waving
wave

kisses
kiss
kissing

drove
drive
driving

ask
asked
asks

walks
walked
walk

called
call
calls

biked
bikes
bike

danced
dances
dance

searching
search
searched

cried
cries
crying

smelled
smell
smells

hates
doesn't
love
hate

likes
liked
like

smiled
smiles
smile

surfing
surfed
surf

felt ill
feeling ill
feel ill

listens
listen
listening