Emotions and emoticons: the use of emoticons during IM conversations and their relation with facial expressions.

User System Interaction
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ABSTRACT
Since the first appearance of emoticons in 1982, research has been done on the impact of emotion-icons in written communication and applications have been developed to help capture emotions and turn them into emoticons. However, a literature review suggests that the assumption of emoticons being equivalent to facial expression has no clear origin. And, on the other hand, there is evidence that emoticons were created as punctuation marks, for which depicted faces acted as mnemonics.

This paper describes an experiment that aims to find out what the role of emoticons is. Firstly, if the mechanism by which emoticons add meaning to written conversations is equivalent to the use of facial expressions in face-to-face conversation or more similar to the use of punctuation in those same written conversations. Secondly, if the use of emoticons enhances emotional expressivity during a written conversation.

After running an experiment in which 10 participants take part in an IM conversation while their faces are being recorded, the correlation between facial expressions and the use of emoticons was analyzed.

The evidence resulting from the data analysis indicates that there is no correlation between the facial expressions produced by the participants while having an IM conversation and the number or type of emoticons, suggesting that their function is fundamentally different. However, more research would be needed to conclude that they are indeed punctuation marks.

INTRODUCTION
In the last decades the means of communication have changed, text based communication has become a popular way of staying in contact, collaborating at the office or just chatting with your friends.[1]

However, there are features of face to face communication that are not present in text based communication: body language, intonation, facial expressions and physical contact, which make it impossible to convey many subtleties and increase the likelihood of misunderstanding. The first modern emoticon appeared in 1982, in a Carnegie Mellon message board as a way to distinguish jokes from literal content in intent to partially solve this problem. [2] Since then, emoticons have become increasingly popular; the biggest users of emoticons being people aged 19 to 25, of which 68% said they use them daily. Still, 48 percent of respondents over 50 reported to use emoticons every day.[3]

This research aims to find out:

1. If the number and type of emoticons is correlated to facial expressivity (the number of instances of facial expressions) for a given instant messaging conversation.
2. If emoticons aid instant messaging text communication by a mechanism equivalent to facial expressions during face to face communication (i.e. if they appear in a context when the facial expression they depict would be appropriate, natural and spontaneous), or they adopt a role akin to punctuation marks and perform the same function (non-verbal communication) through a mechanism of their own.

The hypotheses in the second research question are founded on literature review, which shows that many applications and studies have already been developed based on the assumption that emoticons are the facial expressions of written text (for example: 4 5 6 7). On the other hand, emoticons were clearly created to be punctuation marks, with the face working only as a mnemonic for the meaning [8] . However, no evidence was found to support either of these hypotheses.

METHOD

In the experiment, 10 people participate in an instant messaging conversation with an experimenter. Their faces are recorded and merged with a screen cast of the chat window, so facial expressions and the use of emoticons are recorded for each of them.

The topic of the conversations was fixed to "childhood memories". The participants were told they were going to chat with another person and the goal was to try to find out about each other's childhood. They were given a set of sample questions about a person's childhood that could be used for this purpose, although they were told that they did not need to restrict to them.

Participants were chosen among acquaintances of the experimenters to facilitate the expression of emotions [9] and provide a more natural setting for chatting. Participants also had different nationalities and cultural backgrounds. They were also chosen so their ages were between 20 and 30 years old, to increase the likelihood that they are frequent users of emoticons[10].

Table 1: frequent use of emoticons by participant. The coding was provided by the participants themselves.

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
smile/j.	Y	y	Y	Y	y	y	Y	y	Y	y
sadness			Y		Y		Y		Y	Y
irony/j.	Y	Y	Y	Y	Y			Y	Y	Y
laugh						Y				
surprise			Y			Y			Y	
confus.	y							Y	y	

A questionnaire that was handed out after the experiment identified the participants as frequent users of several emoticons (Table 1), with 70% using emoticons often and 30% only sometimes.

To control for context and the nature of content, the experimenters restricted themselves to a set of fixed anecdotes that they narrated to the participants. The same anecdotes were approximately only half the time accompanied by emoticons. The sample questions also provided some implicit guideline (most participants chose to stick to the provided questions) keeping the conversation structured but natural.

DATA ANALYSIS

The data in the videos was coded in the following way:

- Emoticons were split between sent (produced by the participant) and received (produced by the experimenter)
- Emoticons were split by type (combination of characters) and then coded into categories according to their meaning, as found on the Internet[11] (Table 2).

Table 2: Emoticons used during the experiment and their coding

Smiling/joy	:)
Sadness	:(:'(
Irony/joking	;) :P
Laughing	:D XD
Surprise	:O /o\
Confusion	:S 8-|

- Facial expressions were coded into the same categories that resulted from analyzing the emoticons split by type. Some other categories are added to complete the 6 universal facial expressions [12]: smiling/joy, laughing, thinking, irony/joking, confusion, surprise, sadness, anger, disgust, fear, embarrassment.
- Fillers and onomatopoeias were also counted (as a total number for each participant). These are some examples of the fillers and onomatopoeias found in the conversations: *hehe*, *hmmm*, *ahhh*, *oh*, *ops*.

Some difficulties were encountered during the coding of the conversations. However, none of these difficulties were considered to have seriously affected the accuracy of the results because of their relatively mild occurrence.

- Sometimes, some of the participants moved during the recording and only part of their face was visible.
- Some of the participants made gestures with their hands, covering part of their faces.
- Different participants had different baseline expressions. For some a neutral expression included a mild smile already, while for others the same mild smile was actually an expression of joy.

- Some participants produced unclear facial movements, which did not belong to any of the categories in the experiment (for example, tics).

Then, facial expressions were tested for correlations to the use of emoticons on the following criteria:

1. Total number of emoticons against total number of instances of facial expressions.
2. Number of emoticons by source (i.e. sent/received) vs. total number of instances of facial expressions.
3. Number of emoticons by category (i.e. smiling, sadness, irony/joking, laughing, surprise, confusion) vs. the total number of instances of facial expressions.
4. Number of emoticons by category vs. the number of instances of the facial expression corresponding to that emoticon category (i.e. instances of surprised facial expressions vs. number of surprise emoticons used).
5. Number of emoticons vs. number of instances of facial expressions vs. fillers and onomatopoeias. Where emoticons, fillers and onomatopoeias are discriminated by source.

To test for correlations, linear regression was used in the first four cases. The following assumptions were made in order to apply this method:

- The sample was assumed to be representative of the population for the chosen age group since participants were chosen from different cultural backgrounds.
- The error on the correlation between emoticons and facial expressions was assumed to arise from particularities of the context (history of the overall instant messaging conversation) and variation of habits across participants. To avoid bias caused by context a large number of instances of emoticons were used in different contexts (104 received, 71 sent). In this case, the assumption that the error terms are normally distributed is not needed because the central value theorems imply that, as long as the error terms have finite variance and are not too strongly correlated, the parameter estimates will be approximately distributed even when the underlying errors are not. For errors arising from participants habits and familiarity with the use of some subset of emoticons, the assumption of a random variable with a mean of zero conditional to the dependent variable (emoticons) is needed because the sample of participants is small (10). After analyzing the data from the questionnaire (Table 1) and comparing it to the numbers of sent and received emoticons by participant, no correlation between emoticon use preference and actual use during the experiment was found (Table 3). Therefore, the error can be wholly attributed to variation within the population (of which the participants are a representative sample) for each emoticon and assumed to be normally distributed. Variances of all errors are assumed to be finite and constant across all observations and the errors are assumed to be uncorrelated.

Table 3: This table shows the lack of correlation between participant habitual emoticon use (in red) and actual number of sent and received emoticons during the experiment.

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
smile/j.	9	8	8	1	3	1	5	5	9	21
sadness	1	2	3	0	0	0	1	0	2	0
Irony/j.	5	5	24	0	1	1	3	1	0	7
laugh	1	5	11	2	0	2	1	1	1	2
surprise	1	0	2	1	0	1	0	1	1	0
conf.	0	1	0	1	0	0	1	1	2	0

- The independent variables (number of emoticons) are assumed to be error free.
- And, because there's no literature describing combination of two emoticons to express the emotion depicted by a third and no instances of that happened during the experiment, emoticons are assumed to be linearly independent.

The fillers were only counted by participant, without any coding, to test if their number has an effect in the correlation between the use of emoticons and facial expressions. Only an analysis by visual inspection was performed.

RESULTS

No correlations were found between the use of emoticons and facial expressions for any of the categories.

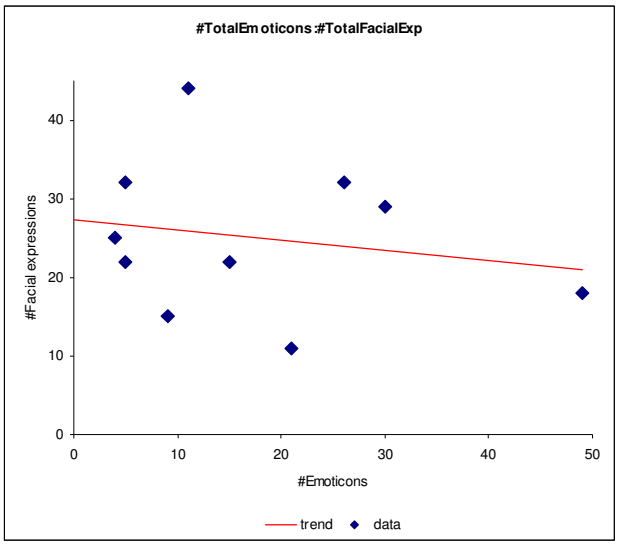

Figure 1: Correlation between the total number of emoticons (sent and received) and the total number of facial expressions (all categories); m=-0.09, b=17.6, R2=0.004.

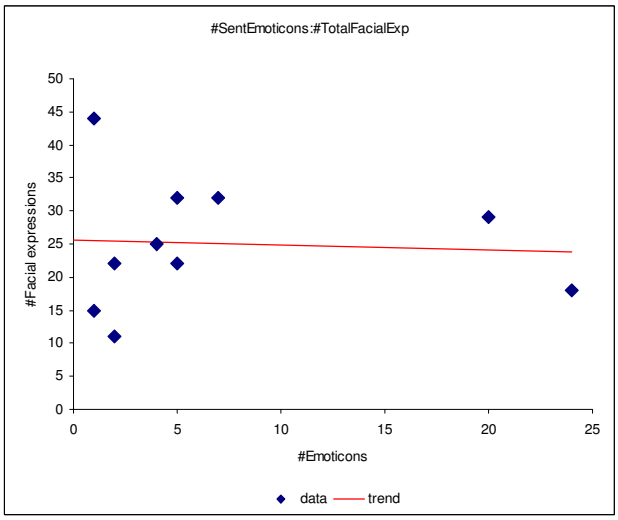

Figure 2: Correlation between the total number of sent emoticons and the total number of facial expressions (all categories); m=-0.07, b=25.5, R2=0.004.

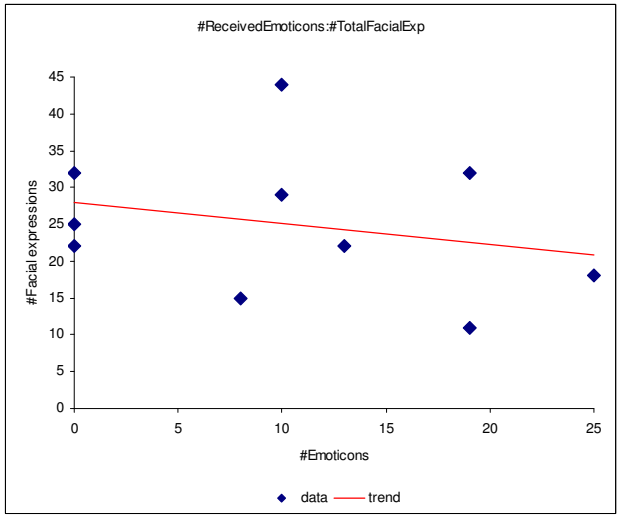

Figure 3: Correlation between the total number of received emoticons and the total number of facial expressions (all categories); m=-0.28, b=27.9, R2=0.07.

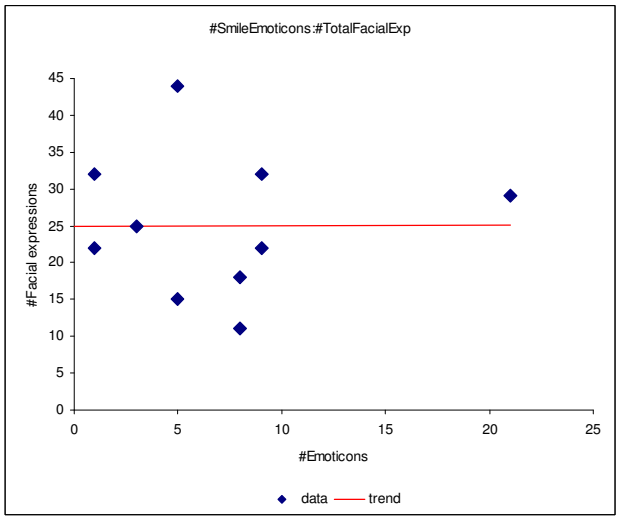

Figure 4: Correlation between the smile emoticons (sent and received) and the total number of facial expressions (all categories); m=-0.003, b=25.0, R2=4E-6.

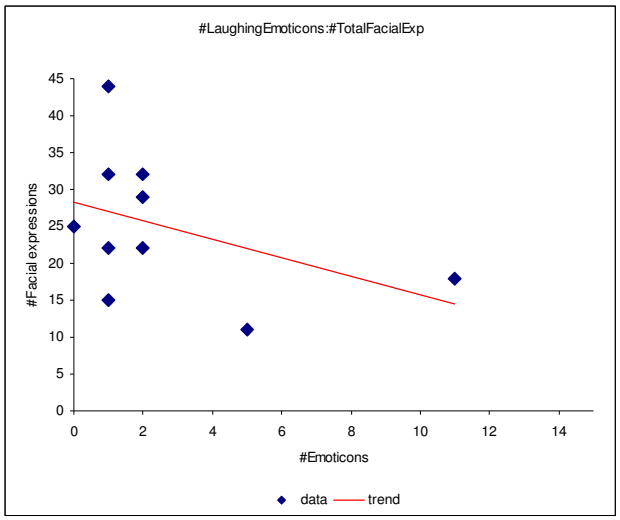

Figure 5: Correlation between laughing emoticons and the total number of facial expressions (all categories); m=-1.25, b=28.3, R2=0.17.

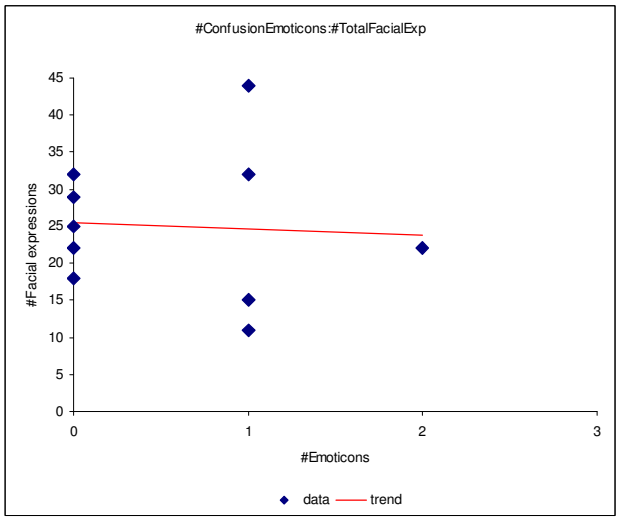

Figure 7: Correlation between confusion emoticons and the total number of facial expressions (all categories); m=-0.90, b=25.5, R2=0.04.

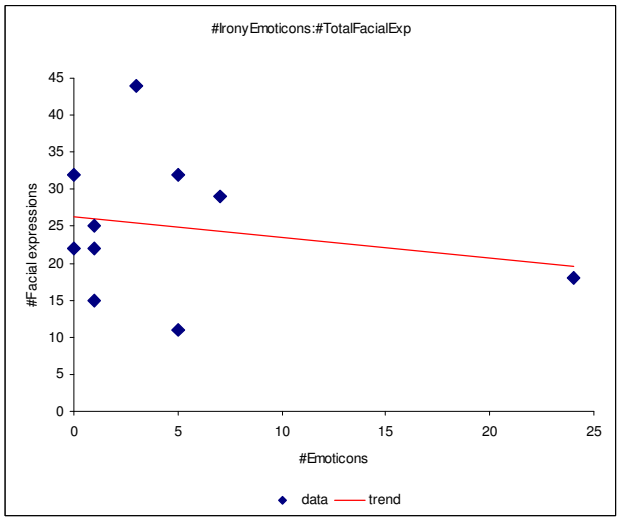

Figure 6: Correlation between irony emoticons and the total number of facial expressions (all categories); m=-0.28, b=26.3, R2=0.04.

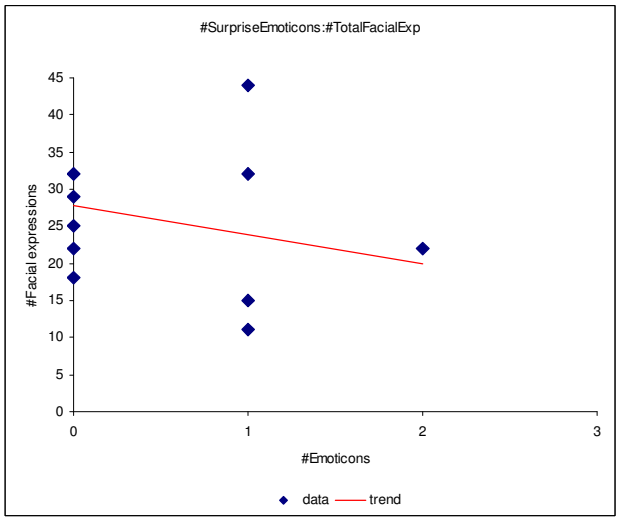

Figure 8: Correlation between surprise emoticons and the total number of facial expressions (all categories); m=-3.90, b=27.7, R2=0.07.

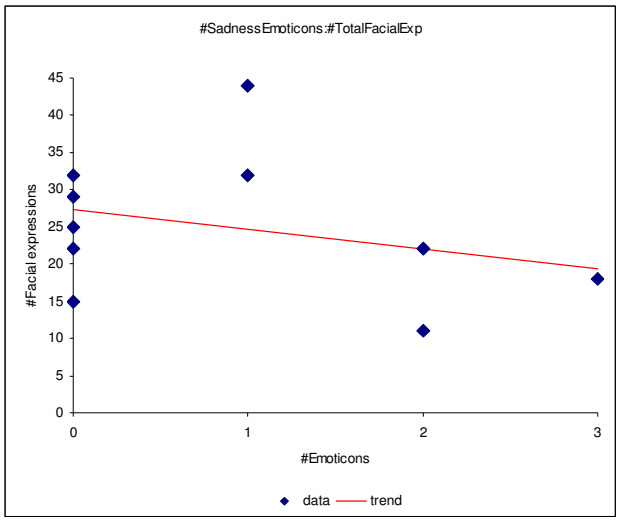

Figure 9: Correlation between sadness emoticons and the total number of facial expressions (all categories); m=-2.66, b=27.4, R2=0.09.

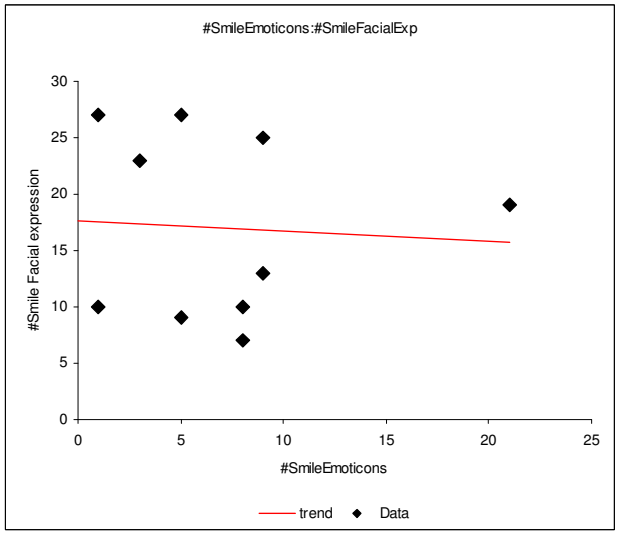

Figure 10: Correlation between smile emoticons and smile facial expressions; m=-0.09, b=17.6, R2=0.004.

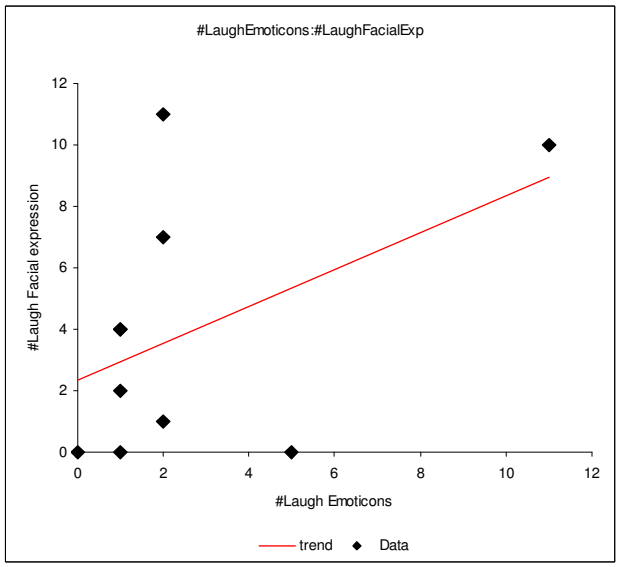

Figure 11: Correlation between laughing emoticons and laughing facial expressions; m=0.60, b=2.34, R2=0.22.

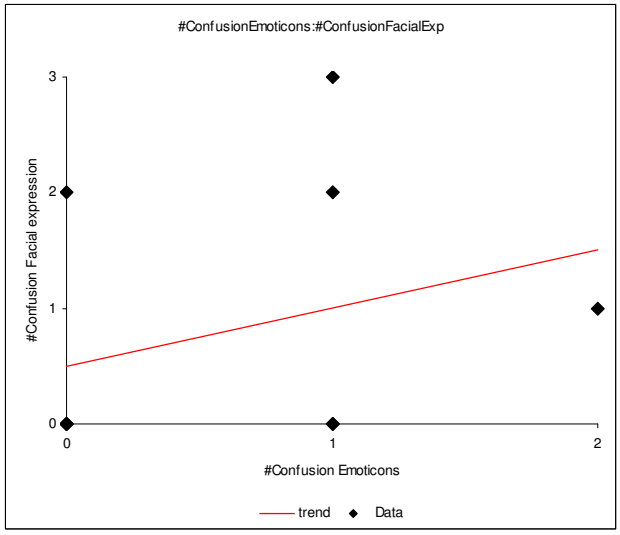

Figure 12: Correlation between confusion emoticons and confusion facial expressions; m=0.5, b=0.5, R2=0.09.

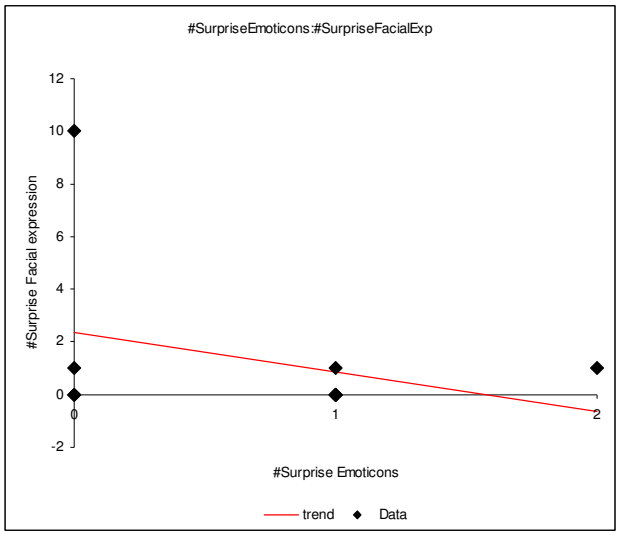

Figure 13: Correlation between surprised emoticons and surprised facial expressions; m=-1.49, b=2.34, R2=0.11.

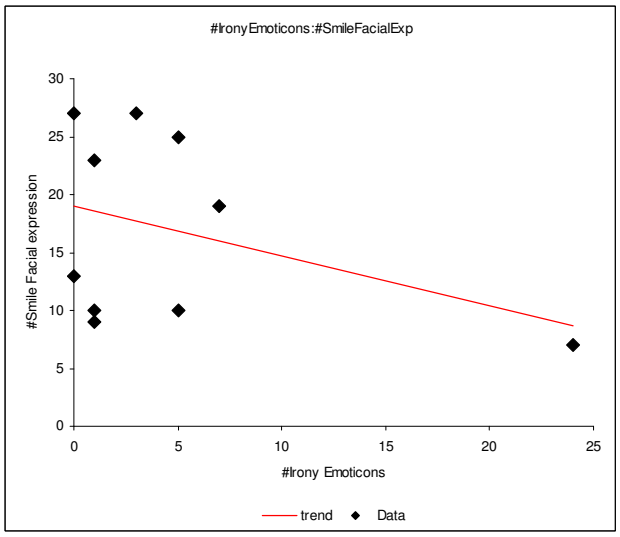

Figure 14: Correlation between irony emoticons and smile facial expressions; m=-0.43, b=19.0, R2=0.15.

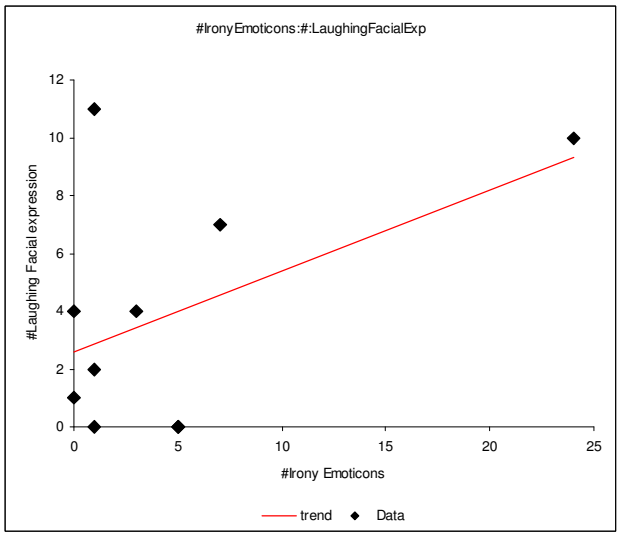

Figure 15: Correlation between irony emoticons and laughing facial expressions; m=0.28, b=2.58, R2=0.24.

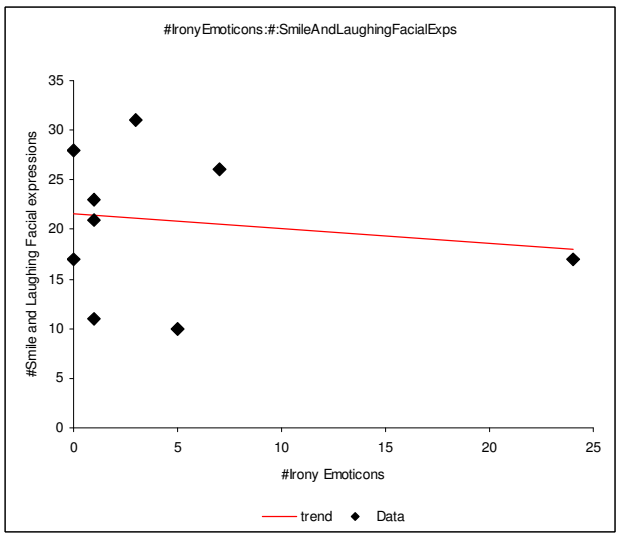

Figure 16: Correlation between irony emoticons, and laughing and smile facial expressions; m=-0.15, b=21.6, R2=0.02.

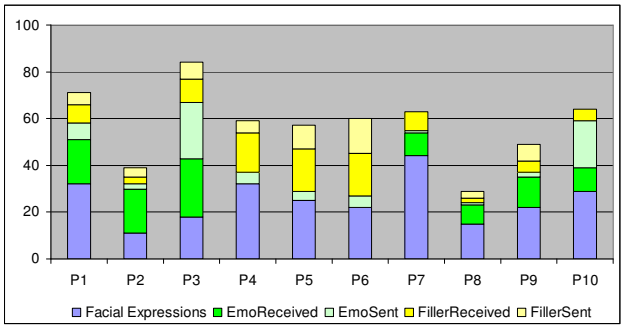

Figure 17: Number of emoticons (sent and received), fillers (sent and received) and facial expressions, for each participant.

DISCUSSION AND CONCLUSIONS

The use of emoticons is not correlated with the use of facial expressions for any of the categories compared during this research.

In the first place, neither the total number of emoticons used, nor any emoticon category, correlates to the total number of facial expressions. This suggests that emoticons are not correlated with the emotional expressivity in a conversation.

Also, each emoticon category is not correlated to the number of instances of the facial expression they depict. This suggests that emoticons are not a mere replacement of facial expressions. During IM conversations they may fulfill a function equivalent to the one that facial expressions have in the face-to-face context [13], namely: provide contextual or emotional metadata. However, they seem do so through a different mechanism. To provide a more conclusive proof, we suggest the following experiment. A similar setup is arranged for participants to take part in an IM conversation, but this time their faces are recorded in-sync with the IM conversation. Then the simultaneity of the use of facial expressions and emoticons (or the lack of it) can be analyzed to definitely assess if emoticons and facial expressions occur in the same context, with the same objective and convey the same meaning.

One possible explanation for the findings would be that emoticons, rather than replacing facial expressions, work as punctuation marks. In this case, they would provide information about how a message should be decoded in terms of the feelings of the person producing the emoticon but through a mechanism akin to punctuation, which relates more to intonation than to facial expressions. The information extracted from filler analysis (visual inspection) seems to indicate that when the total number of emoticons (sent and received) decreases, fillers (employed by the participants) increase. However this is inconclusive because, in conversations were no emoticons were used, the experimenter also used more fillers. This could have biased filler use, if participants tended to mimic the experimenter's behavior. It seems worthy to further explore this relationship between filler use and emoticons since it suggests some form of equivalence. Given that fillers are voicings, and hence related to sound, a relationship could further point in the direction of emoticons being on the realm of punctuation marks. However more research is necessary to test the "emoticons as punctuation marks" hypothesis.

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[13] Daantje Derks, Arjan E. R., Jasper Von Grumbkow, “Emoticons and Online Message Interpretation”, Social Science Computer Review archive, Volume 26 , Issue 3 (August 2008) table of contents, Pages 379-388