Do face emojis elicit parafoveal-on-foveal effects during sarcasm comprehension? Evidence from eye tracking in Chinese

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Background: Recent research has shown that emojis can influence the processing of preceding text through parafoveal-on-foveal (PoF) effects, whereby information in peripheral vision modulates processing of the currently fixated word. Sheridan et al. [1] demonstrated that object emojis (e.g., a basketball emoji following "ball") elicit early PoF effects in English reading: readers fixated the preceding word for less time when the upcoming emoji was semantically congruent. However, it remains unknown whether *face* emojis, which carry emotional rather than referential meaning, produce similar effects, and whether such effects extend to figurative language like sarcasm, where a word's surface meaning diverges from the speaker's intention. This is particularly relevant to Chinese digital communication, where the WeChat "smiley" emoji (🙂) has a distinctive pragmatic function as a marker of sarcasm among younger users [2].

Method: We conducted a pre-registered eye-tracking study (N = 65 native Chinese speakers; EyeLink 1000) using a 2 × 3 within-subjects design crossing Sentence Type (sarcastic vs. literal) with Emoji Valence (WeChat smiley, frowny, no emoji), using 48 experimental stimuli and 44 filler items. Stimuli (Table 1) consisted of context–target sentence pairs adapted from Huang et al. [2]. In sarcastic sentences, a preceding context established an ironic reading, so that the critical word (e.g., "好" [good]) was positive on the surface but negative in intent; in literal sentences, it was negative (e.g., "差" [bad]). The critical word was penultimate, with the emoji in sentence-final (parafoveal) position. We defined *congruent* conditions as those where the emoji's emotional valence matched the critical word's surface valence: sarcastic + smiley ("good" +🙂) and literal + frowny ("bad" +☹️). Reading times (first fixation duration [FFD], gaze duration [GD], go-past time [GP], total time [TT]) and skipping probability were analysed on both critical regions, the critical word and the emoji, using linear mixed-effects models with pre-registered orthogonal contrasts. Critically, first-pass measures on the critical word could reveal a PoF effect, as the emoji occupies the parafovea before it is directly fixated.

Results: First-pass measures (FFD, GD, GP) showed no significant effects. Later measures revealed two distinct patterns (Table 2, Figure 1). First, an *emoji engagement effect*: emoji presence increased total time on the critical word by ~9% and reduced skipping probability, both symmetric across sentence types. Second, a *semantic congruency effect*: within emoji-present conditions, total time on the critical word showed a significant Sentence Type × Valence interaction, with congruent pairings accumulating less re-reading. This crossover was more robust on the emoji itself, where GP and TT showed clear congruency interactions: emojis that mismatched the critical word's surface valence attracted disproportionately longer reading. No main effect of valence reached significance, ruling out a simple emoji valence bias.

Discussion: Contrary to predictions, face emojis did not elicit classic PoF effects. Instead, effects emerged in total time (which includes regressions back to the critical word after fixating the emoji), indicating post-fixation integration rather than parafoveal pre-processing. This late re-reading was sensitive to the match between the emoji's emotional valence and the critical word's surface valence, operating at the lexical level: sarcasm processing was facilitated when the emoji matched the word's semantic meaning. These findings establish a boundary condition for emoji-driven PoF effects: while object emojis trigger rapid parafoveal facilitation [1], face emojis influence comprehension through a slower, integrative mechanism that accumulates across fixations. This dissociation provides the first evidence that the time course of emoji–word integration depends on the type of information the emoji encodes.

Table 1. Example stimuli. Sarcastic sentences use positive critical words (bold) with a preceding ironic context; literal sentences use negative critical words. Congruent = emoji valence matches the critical word's surface valence.

Sentence	Emoji (Valence)	Example	Match
Sarcastic	no	王璐发现你的画不是很好看。她发消息给你：画得太**好**了 [Wang Lu found your drawing is quite bad. She messaged you: What a **beautiful** drawing]	
Sarcastic	smiley	…What a **beautiful** drawing 🙄"	Congruent
Sarcastic	frowny	…What a **beautiful** drawing 😟"	Incongruent
Literal	no	王璐发现你的画不是很好看。她发消息给你：画得太**差**了 [Wang Lu found your drawing is quite bad. She messaged you: What a **bad** drawing]	
Literal	smiley	…What a **bad** drawing 🙄"	Incongruent
Literal	frowny	…What a **bad** drawing 😟"	Congruent

Table 2. Fixed-effect estimates (β) from linear mixed-effects models on the critical word and emoji region. Duration DVs are log-scaled; skipping is logit-scaled. †p < .10, *p < .05, **p < .01, ***p < .001.

Effect	FFD	GD	GP	TT	Skip	Region
Sent Type	−.018	−.030	−.028	.003	.101	Word
Presence	−.020	.012	−.011	**.089*** **	**−.995*** **	Word
Valence	.006	.032	.047†	.028	−.148	Word
Sent × Val	.019	.005	−.040	**−.106***	−.463†	Word
Sent × Val	−.048	−.135†	**−.305****	**−.194***	—	Emoji

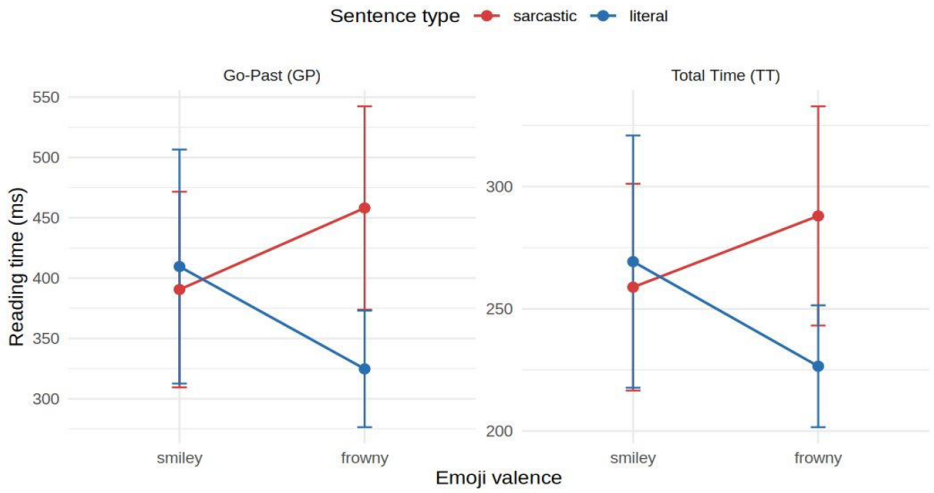

Figure 1. Emoji region reading times (ms) by Sentence Type and Emoji Valence for go-past time (left) and total time (right). The crossover shows that semantically congruent pairings (sarcastic["good"] + smiley; literal["bad"] + frowny) are processed faster than incongruent pairings. Error bars = 95% CIs.

References

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