Embodied Responses to Disgust Metaphors: Ontological vs. Orientational

Iris 张佳琳, Jules 彭梓铭, Jenny 张宇霖

Overview

The study investigates the linguistic processing of various disgust metaphors, drawing on the theoretical framework of Conceptual Metaphor Theory and embodied cognition.The objective is to ascertain the universality or linguistic specificity of the cognitive and physiological instantiation of these metaphors.The present study utilizes facial electromyography (EMG) and subjective assessments to contrast the physiological and emotional responses of participants to ontological metaphors, anchored in sensory experiences, and orientational metaphors, based on spatial schemas.The research is formulated to test two competing theories regarding the embodiment of metaphorical language.The research is formulated to test two competing theories regarding the embodiment of metaphorical language.

Specific Aims

1.To provide a fresh test of the Embodied Cognition theory by investigating whether different kinds of disgust metaphors produce various physiological reactions, assessed by LLS muscle activation.

2.To see if how metaphorical expressions of disgust are processed differently when the source domain is ontological as compared to orientational, which impacts the subjective and physical reactions.

3.To test our main hypothesis that metaphor using concrete, sensory experiences as their source-domain will be more evocative and lead to a stronger sense of embodied disgust compared to metaphor based on more abstract, spatial metaphors.

Background

Disgust, a basic human emotion, has evolved to function as a protective mechanism against contamination, disease, and moral violations (Rozin et al.)., 2000).In everyday discourse, this emotion is expressed metaphorically, for instance, through "His behavior stinks" or "That was a low thing to do.".These metaphors are not merely stylistic; they signify a profound cognitive process that locates abstract emotions within the realm of physical sensations and spatial schemas.These metaphors are not merely stylistic; they signify a profound cognitive process that locates abstract emotions within the realm of physical sensations and spatial schemas.

The Conceptual Metaphor Theory, as outlined by Lakoff and Johnson (1980), posits that abstract concepts like morality and emotion are structured by metaphorical mappings rooted in concrete source domains, including physical experiences and spatial.The framework is substantiated by embodied cognition, positing that metaphor comprehension entails the simulation of sensory or motor experiences from which metaphors originate (Barsalou, 2008).Objective measurement of disgust simulations is attainable via facial electromyography (EMG), specifically by monitoring the activity of the levator labii superioris (LLS), a facial muscle indicative of the canonical disgust expression (Chapman et al., 2009).

The field of cognitive linguistics has recently proposed a systematic categorization of metaphors, reflecting their underlying cognitive structures.Within the temporal domain, English speakers frequently utilize horizontal metaphors, e.g.,...", eagerly awaiting the weekend," in comparison to vertical metaphors in other linguistic systems.The principle indicates that efficacy in evoking sensory and emotional systems varies across different metaphorical categories.The analysis of disgust metaphors in this research is grounded in the application of this logic, focusing on a comparative approach to ontological and Orientational metaphors.The present study utilizes this logic to analyze disgust metaphors, with a particular emphasis on contrasting ontological and orientational metaphors.

Ontological metaphors conceptualize disgust as something physical or bodily connected with smells, decay, or dirty(e.g., "His actions were rotten to the core").

Orientational metaphors map disgust onto schema of space, usually verticality or depth, to indicate moral deterioration or low social standing (e.g., "That was a low act").

Methods

Participants Sixty native English speakers from the university community (N=60) will participate in this study and receive compensation. All participants must be right-handed, aged 18 to 35 years, have normal or corrected-to-normal vision, and have no history of neurological or psychiatric disorders. Individuals who have undergone facial surgery, suffer from dermatological conditions affecting electromyography (EMG) testing, or have known taste hypersensitivity will be excluded. All participants must sign an informed consent form, and the study protocol must be approved by the university's Institutional Review Board (IRB).

Materials Stimulus materials will be selected from the Muhammad Metaphor Corpus(Mohammad et al., 2016) and published conceptual metaphor experiments, excluding self-generated items. Six neutral background texts (2–3 lines each, e.g., social media posts, workplace reports) will be created. Each background text will be

paired with three target sentences: one containing a directional metaphor, one containing an ontological metaphor, and one neutral control sentence. Candidate items will be classified by three trained coders; only items with consistent classification results will be retained. To avoid metaphor family overlap, polysemous words (e.g., darkness, murkiness, shadow) will be excluded by analyzing contextual and semantic properties(Lakoff & Johnson, 1980).

Instance：

Background: The film was heavily criticized after its premiere, with many viewers expressing

disappointment.

The movie left the audience feeling very _____.

1.orientational: down

2.ontological: rotten

3.neutral: strange

All items will be matched for sentence length (±2 words), lexical frequency, and syntactic complexity. The concreteness of metaphor core words will be controlled via WordNet semantic depth, with directional-ontological word pairs differing by no more than one level. In the normative study (N=40), participants will rate disgust, naturalness, and familiarity on a 7-point scale. Items with naturalness scores <4 or excessive cross-item variance will be excluded. The final dataset comprises 12 directional-ontological pairs (24 sentences) and 12 neutral sentences, totaling 36 items.

Procedure　Each participant will undergo facial electromyography recording,which is reliably associated with disgust responses(Chapman et al., 2009), during reading and rating tasks，. The experiment employs a Latin-square balanced single-subject design: each participant will view one target sentence per background (six sentences total), plus neutral filler sentences and attention check sentences.

Each trial will follow the sequence: fixation cross (800–1000 ms), background passage (2500–3000 ms), target sentence (2500–3000 ms), and rating screen. Participants will rate disgust/emotional intensity on a 7-point scale (1 = not at all, 7 = extremely). An inter-trial interval of 1500–2000 ms will separate trials. Each participant will complete 12 critical trials and 3–4 filler trials; the entire session is expected to last approximately 15–20 minutes (fig 1). This trial structure follows standard procedures in emotion and language processing studies (Bayer et al., 2012).

Facial electromyographic signals will be recorded from the left levator labii superioris (LLS) muscle using bipolar Ag/AgCl electrodes (4 mm), following established protocols for measuring facial disgust(Fridlund & Cacioppo, 1986). The working electrode is positioned approximately 1 cm lateral to the nasolabial fold and 1.5 cm below the alar base; the reference electrode is placed approximately 1–1.5 cm lateral and inferior to the muscle fiber direction. The ground electrode is placed at the Fpz point. Electrode sites are cleaned with alcohol and lightly abraded to maintain impedance <10kΩ. Signals are amplified (approximately 1000× gain), sampled at 1000Hz, and filtered online through a 20–450Hz bandpass filter and a 50Hz notch filter(Tassinary et al., 2007).

Baseline activity will be calculated starting 300 milliseconds before target stimulus onset. The analysis window is set to 500–3000 milliseconds after target stimulus onset,consistent with previous affective EMG studies(Lang et al., 1993) . EMG signals undergo rectification followed by smoothing with a 50-millisecond moving average. Outliers exceeding ±3.5 standard deviations in amplitude will be excluded. Subjects with an effective trial rate below 70% will be excluded. Response values will be standardized intra-subject using z-scores(Fridlund & Cacioppo, 1986).

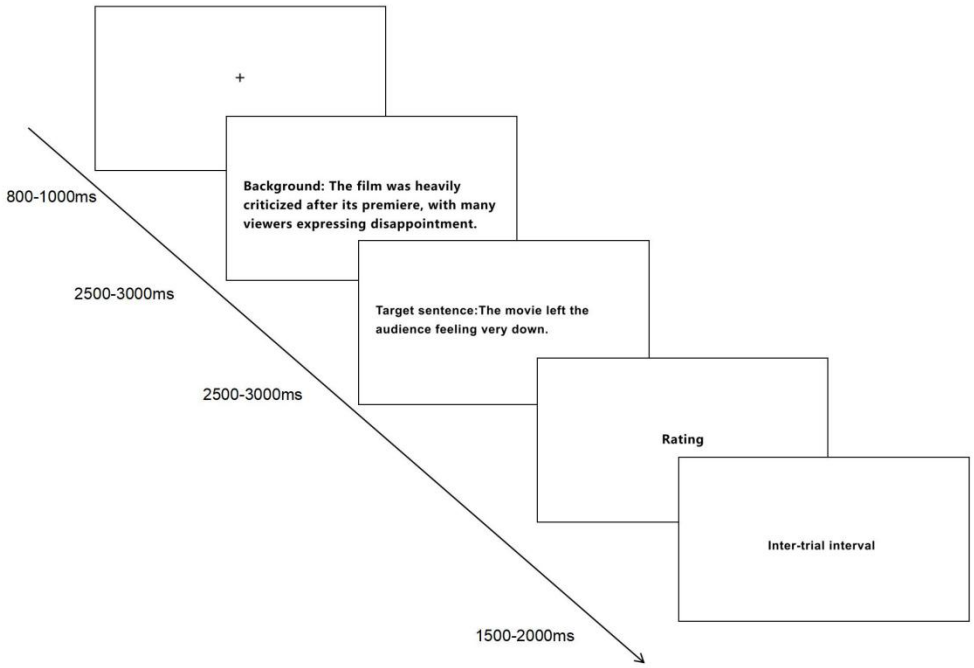


Figure 1. Flowchart of a single trial. Each trial will begin with a fixation cross (800–1000 ms), followed by a background passage (2500–3000 ms) and a target sentence (2500–3000 ms). Participants then will provide a rating (disgust/emotional intensity, 1–7; optional: naturalness/familiarity), before an inter-trial interval (1500–2000 ms).

Predictions

In order to test our hypotheses, we offer a set of precise, falsifiable predictions concerning the results of our dependent measures-self-report scores on measures of disgust and facial EMG data.

Prediction 1 (P1): Supporting the Metaphor-Category Potency Hypothesis

If our primary hypothesis holds true, we anticipate that ontological metaphors will be significantly more potent in eliciting disgust than orientational metaphors. This pattern is expected to be consistently reflected across both our subjective and physiological measures.

Subjective Ratings: Participants will report significantly higher disgust ratings on a 1-7 scale after reading sentences containing ontological metaphors compared to those with orientational metaphors.

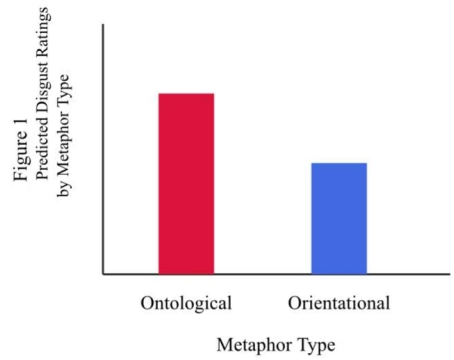
Facial EMG: The mean amplitude of levator labii superioris (LLS) muscle activation will be significantly greater following the presentation of an ontological metaphor compared to an orientational metaphor. This outcome would suggest that metaphors grounded in direct, visceral sensory experiences are more effective at triggering an embodied disgust simulation than more abstract, spatial metaphors.

Prediction 2 (P0): Supporting the Null Hypothesis

Conversely, if the null hypothesis is correct, we will observe no statistically significant difference between the two metaphor categories.

Subjective Ratings & Facial EMG: The disgust ratings and EMG activation levels for ontological metaphors will be statistically equivalent to those for orientational metaphors. The effect sizes for any observed differences will be close to zero. This outcome would imply that once a metaphorical mapping for disgust becomes conventionalized within a language, its specific source domain (ontological vs. orientational) does not differentially impact the intensity of the embodied response it elicits.

The following graphs visually represent the expected results under our primary hypothesis (H1).



As illustrated in Figure 1, we predict that sentences containing ontological metaphors will yield significantly higher mean disgust ratings from participants than sentences containing orientational metaphors. This result would provide subjective evidence for the greater psychological potency of ontologically-grounded disgust metaphors.

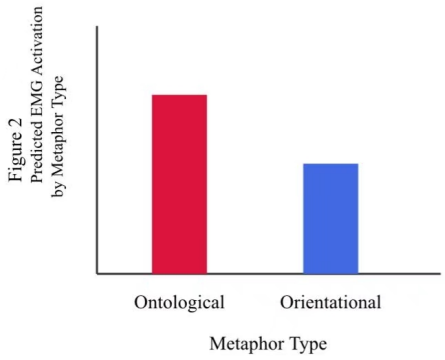


Figure 2 shows the predicted physiological outcome. We expect to find a significantly greater increase in EMG amplitude from baseline for the ontological metaphor condition compared to the orientational metaphor condition. This would provide objective, physiological evidence that the embodied simulation of disgust is stronger for metaphors grounded in direct sensory and bodily experience.

References

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