How humor is experienced: An embodied metaphor account

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Abstract

The study explores the humor-body association from the perspective of embodied cognition. According to the Conceptual Metaphor Theory, abstract concepts tend to be understood with concrete experiences through embodied mappings. Therefore, the current study attempts to investigate how humor, an understudied abstract concept, is perceived in the Chinese context by means of textual analysis and a behavioral experiment. Firstly, 6,500 entries of the corpus data related to laughter and humor in Chinese were used for the textual analysis. Extensive uses of embodied humor metaphors were found, which provided important linguistic evidence for the interaction between laughter, humor, and body. Secondly, a behavioral study was conducted based on some frequently-used embodied metaphorical expressions of humor (e.g., *pěngfù dàxiào* 捧腹大笑, meaning ‘to hold one’s sides laughing’) identified in the corpus. Specifically, the participants were instructed to either do embodied metaphor or non-metaphor actions as bodily primes (i.e., ‘holding one’s belly while bending forward and backward repeatedly’ vs. ‘turning one’s upper body from side to side with both hands on the back’) or perform no actions before completing the subsequent joke rating task and the mood rating task. Results showed that the participants who were primed with the embodied metaphor actions rated the jokes higher than those in the control groups who were primed with non-metaphor actions or had no primes. Also, there was no significant difference in the mood ratings across the groups. These findings suggest that embodied humor metaphors indeed affect humor experience and shape how humor is conceptualized. The current study supports not only the embodied view of humor understanding but also the conceptual metaphor account of abstract reasoning, which sheds new light on the theoretical development of the embodiment of abstract concepts.

Keywords Humor appreciation · Embodied cognition · Conceptual metaphor · Bodily primes · Abstract concept

Introduction

The classical view of cognition holds that people’s concepts of the world are represented by abstract and amodal symbols in the mind (Fodor, 1975). However, in recent decades, this view has been challenged by theories of embodied and grounded cognition, which posit that people’s knowledge of the world is fundamentally grounded and anchored in multiple bodily ways such as simulations, situated actions, and bodily states (Barsalou, 1999, 2008; Gibbs, 2005; Glenberg, 1997; Lakoff & Johnson, 1999). Under this experientialist view of cognition, language understanding is also suggested to be fundamentally rooted in people’s sensorimotor and emotional experiences. For example, it would not be surprising if one finds a sentence like “*A man is standing in the sky*” hard to understand. The underlying reason is that the action of “*standing*” at the particular location “*sky*” violates people’s bodily experience of gravity, and therefore, one immediately knows that the sentence would not be true

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since people will undoubtedly fall instead of maintaining the state of standing in the sky.

Substantial studies have tested and demonstrated the embodied view of language understanding in terms of bodily actions (Andres et al., 2015; Glenberg & Kaschak, 2002; Klepp et al., 2017; Scorolli & Borghi, 2007; Wu & Coulson, 2015) and various object properties (de Koning et al., 2017; Zwaan & Pecher, 2012), such as color, orientation, shape, and size. Neurophysiological studies among both healthy and lesioned participants have also provided supportive evidence indicating the activation in somatosensory brain areas during tactile, olfactory, gustatory, sound knowledge processing (Goldberg et al., 2006; Trumpp et al., 2013) and somatotopic activation in the brain premotor and motor areas during action verb comprehension (de Vega et al., 2014; Fernandino et al., 2013; see Pulvermüller & Fadiga, 2010 for a review).

However, despite that much consensus has been reached regarding the embodied nature of concrete language processing, it remains unsettled for the processing mechanism underlying abstract concepts (for reviews, see Borghi et al., 2017; Dove, 2016). Without concrete referents, it seems hard for abstract concepts to build a direct representation in the sensorimotor system. Therefore, embodied cognition theories are often criticized for their inadequacy in the explanative power as to how people process abstract concepts (Dove, 2011). Nevertheless, the issue of abstraction can be addressed by Conceptual Metaphor Theory (Lakoff & Johnson, 1980), which argues that the grounding of abstract concepts is mediated through embodied metaphors that map the concrete experience onto abstract domains (see also Gibbs et al., 1994; Gibbs, 2006; Jamrozik et al., 2016). Under this account, for example, it is predicted that the spatial metaphor GOOD IS UP would bridge between the abstract domain of VALENCE (e.g., good/bad) and the concrete domain of VERTICALITY (e.g., up/down), which further makes it possible for the abstract concept to activate the corresponding sensory system that is responsible for spatial representation (Casasanto & Dijkstra, 2010). In recent years, accumulating empirical evidence has shown that a variety of concrete bodily sensations such as space, weight, and cleanness are recruited in making sense of abstract concepts ranging from time (Gu et al., 2017), power perception (Machiels & Orth, 2017), emotional valence (de la Fuente et al., 2017), to quantity/number (Sell & Kaschak, 2012), religious concept (Chasteen et al., 2010), social judgment (Schaefer et al., 2018), etc.

Embodied Metaphor and Humor

As briefly introduced above, embodied metaphors allow us to ground abstract concepts in certain concrete experience. It triggers our curiosity as to whether humor, as an abstract

concept, is understood through conceptual metaphors which are primarily rooted in specific concrete experiences. Few studies to date have been dedicated to humor-body association from the perspective of conceptual metaphor using empirical methods. Thus, the current study aims to investigate, in the context of Chinese, how the humor experience¹ is modulated through embodied metaphor if any.

An essential prerequisite to the empirical inquiry of humor-body connection is the existence of humor-related embodied metaphor in common linguistic expressions, which has been suggested in English and German. Gibbs et al. (2018) and Samermit and Gibbs (2016) analyzed humor-related language in English and found a salient HUMOR IS FORCE metaphor, which could be further divided into multiple conceptual metaphors, such as HUMOR IS AN OPPONENT (*He was overcome with laughter.*), HUMOR IS A PHYSICAL FORCE (*Her joke knocked me off my feet.*), and HUMOR IS A SPECIFIC BODILY DISTURBANCE (*Gary's jokes were side-splitting.*). Compared with English, embodied metaphors of humor in German featured with more varieties (Müller, 2015). In addition to the similar HUMOR IS FORCE metaphor (*unbändiges Lachen* 'irrepressible laughter') as in English, humor was also conceptualized by internal bodily experience in the German context, which was instantiated in metaphors like HUMOR IS SENSORY PERCEPTIONS (*bitter lachen* 'laugh bitterly') and HUMOR IS LOCATED IN THE BODY (*Mit einem fröhlichen Lachen auf den Lippen* 'a merry laugh on her lips'; *Alles lachte ja in ihm* 'everything in him laughed'). In another vein of the research, Ruch et al. (2019) investigated the attributes associated with laughter. In their Study 1, Ruch et al. (2019) classified six categories of laughter-related attributes by sorting out all co-occurred terms with the flections of *lachen* (meaning 'laughter' or 'to laugh') in a number of German corpora. One of the categories of the laughter-related attributes was intensity, containing features such as the degree to which the body is involved in laughing (e.g., *bebend*, meaning 'quivering'; *krampfartig*, meaning 'spasmodic'). In other words, this attribute of laughter suggests that it is common for one to describe the intensity of laughter with terms depicting the degree of bodily involvement. Although the embodied metaphor is not the focus of their study, Ruch et al. (2019) adds supplementary linguistic evidence to a close relation between laughter and the body.

¹ The term "humor experience" in this study is defined as "the perceived or experienced funniness". According to Ruch (2008), the essence of humor experience is "the perception that something is 'funny'". Therefore, the terms "humor experience" and "funniness experience" are used as synonyms and are interchangeable in this article.

With the current study focusing on Mandarin Chinese, the above linguistic evidence from English and German provided important building blocks for further investigation extending to other languages since the habitual use of similar humor-body metaphors may well be motivated by a similar set of bodily experiences shared among different language speakers.

Empirically, one of the most extensively used paradigms in the inquiry of abstract concept processing is to reactivate the concrete sensorimotor experience indicated by the embodied metaphor, and then examine how it may influence the processing of abstract concepts. This paradigm stems from the embodied view of metaphor comprehension (Gibbs, 2006). With embodied metaphors linking concrete experience and abstract concepts, any manipulation of the concrete experience should impact the processing of its abstract counterpart. For example, in order to investigate how vertical space interacts with temporal concepts, Lachmair et al., (2016, Experiment 2) manipulated the body orientations by having the participants stay in a head-up or head-down position on a gym wheel while recalling the previously memorized time-denoting words. The FUTURE IS UP metaphor made sure that the participants recall more future-related words in the upright position. Instead of embodying one single metaphor, Wilson and Gibbs (2007, Experiment 1) primed the participants with multiple bodily metaphors (e.g., *stamp out a fear*, *push the argument*, *swallow your pride*). The participants were asked to mimic and perform the congruent or incongruent actions (e.g., stamp, push, or swallow) before reading the metaphorical phrases. Results showed that with the congruent bodily primes, the participants responded faster in the subsequent word reading task, demonstrating a critical role of embodied metaphors in reasoning about abstract concepts.

Extending this paradigm to humor research, two central pieces of evidence come from Samermit and Gibbs (2016) and Kaspar et al. (2016). Based on the hypothesis that humor is understood through embodied metaphors, Samermit and Gibbs (2016) proposed that embodying actions indicated by common humor metaphors would affect humor (funniness) experience, which would, in turn, facilitate humor production. Under this premise, the participants in the focused group were instructed to pull a manikin leg and yank a chain. The two actions were inspired by two humorous metaphorical expressions in English, namely “*pulling your leg*” and “*yanking your chain*”. Followed by the actions, the participants were asked to add captions for cartoons. These captions were later rated by judges on the level of funniness. The results highlighted the influence caused by metaphor-based actions since the participants in the focused group added funnier captions than those from the control groups who did humor-irrelevant and non-metaphor-based actions. This finding confirmed their hypothesis that changes

made with the concrete domain could modify the perception of abstract concepts. The other study by Kaspar and his colleagues (Kaspar et al., 2016) explored the humor-body association through another embodied metaphor of humor, HUMOR IS LIGHTNESS. This metaphor originates from the WEIGHT IS IMPORTANCE metaphor as exemplified by the idiom “*weighty matters*” (Jostmann et al., 2009). As humor is always perceived as a sense of non-seriousness which is the opposite of importance, it is therefore related to lightness. Kaspar et al. (2016) manipulated the weight of a clipboard on which the cartoons were presented. The participants were required to hold the clipboard while rating the cartoons. It turned out that the female participants in the heavy clipboard group rated lower on the funniness of the cartoons, but the male participants had reversed results. These results were attributed to the gender differences in physical power, muscle mass, and social body weight norms, that is, men, who generally possess more physical power, only perceived the weight of the heavy clipboard as “normal” while women, who are endowed with less power and affected by the “*slenderness is beauty*” social norms, attached the heaviness they felt with the clipboard to the seriousness and therefore had their funniness experience reduced. This finding again complies with the embodied cognition theories since if abstract concepts are grounded in sensorimotor experience through embodied metaphors, different bodily experiences can lead to the formation of distinct metaphors which further influence how the abstract concept is represented (Falck & Gibbs, 2012).

Nevertheless, with these seemingly robust results from previous studies, one should not jump to the conclusion that humor is perceived through embodied humor metaphors since according to facial/bodily feedback theories (Darwin & Prodger, 1998; Riskind & Gotay, 1982), bodily cues can sometimes enhance the corresponding emotional states. For example, Duclos et al. (1989) found that the participants reported a more intense anger feeling if they had performed an anger posture (i.e., clenching fists and leaning the upper body forward). In another study, Strack et al. (1988) conducted a humor-related task in Study 1 and reported a higher rating on the funniness level of the cartoons from the participants holding a pen with teeth (activating facial muscles for a smile) in contrast to holding a pen with lips (inhibiting the facial muscles for a smile). Following the embodiment account of humor, this result could be interpreted that it was the HUMOR IS VISIBLE ON THE FACE metaphor that bridged a smile-like facial expression with humor experience. However, in Study 2, by manipulating the time points at which the participants holding the pen with their teeth, Strack et al. (1988) further suggested that both cognitive and emotional processes were underlying the humorous responses, and the emotional component turned out to have induced a higher rating of cartoon funniness in

Study 1. Summarizing these findings from the perspective of embodied emotion, except for embodied metaphor account, an alternative explanation for the intensified funniness experience is the enhanced emotion of amusement, that is, bodily cues may only elevate emotional experience which in turn influences humor appreciation.

In brief, both linguistic and empirical evidence generally agreed that humor appreciation or production is shaped by embodied mappings between humor and specific bodily actions or sensations, and importantly, more attention should be paid to the role of emotional simulation in the process.

The Present Study

In view of the above studies on the embodiment of humor, two major issues remain unsolved. First, the role of linguistic or cultural variation in shaping the bodily experience of humor was overlooked. Existing evidence of embodied humor metaphors mostly comes from English and German. The native speakers of the two languages experience exclusively a Western culture. As linguistic and cultural habits (e.g., writing direction) may differently shape how people conceptualize abstract notions such as time (Boroditsky et al., 2011; Fuhrman & Boroditsky, 2010), there is a great possibility of a cross-linguistic or cross-cultural variation on the representation of humor. Therefore, it is of significance to find evidence from languages that share little resemblance to the Western counterpart for the purpose of probing into the universality of embodied humor representations among the world's languages. Second, as discussed above, it is debatable whether humor is understood through embodied humor metaphors or embodied emotions because the possible intensified funniness experience can either be explained by humor-related bodily primes or intensified emotional experience of amusement.

The present study attempts to deal with the two untended issues and extend the existing research on humor-body interaction to Mandarin Chinese with a corpus-based textual analysis and a behavioral study. The research questions (Q) and hypothesis are as follows:

Q₁. Are there embodied metaphors of humor in Chinese? If so, what sorts of humor metaphors are they?

According to Lakoff and Johnson (1999), universal linguistic expressions are developed from concepts that arise from universal bodily experiences. Humans share most of the bodily experience at the level of how the body and the brain function, ranging from the common experience of gravity to a similar set of daily routines of eating and sleeping. Therefore, despite that cultural differences may step in to make minor alterations in bodily experiences such as different writing directions and eating styles, we may still find common ground on how we feel humor

and on how we express humor with language (Kövecses, 2005). Accordingly, it is expected that, similar to English and German, embodied metaphors of humor are also used in Chinese. Specifically, both similar conceptual metaphors (i.e., due to common bodily experience) and different ones (i.e., because of cultural variations) are expected to appear in the Chinese corpus.

Q₂. Whether embodying actions indicated by the embodied humor metaphors in Chinese will affect humor appreciation?

In light of the findings from previous studies (Kaspar et al., 2016; Samermit & Gibbs, 2016; Strack et al., 1988), a positive correlation was found between specific body manipulations and humor production (i.e., adding humorous captions for cartoons) or perception (i.e., cartoon ratings). It is therefore hypothesized that:

Hypothesis to Q₂. Embodying common bodily metaphors of humor will enhance people's funniness experience with jokes.

Q₃. What role does emotion play in humor appreciation? Whether emotion or embodied humor metaphors lead to an increased sense of humor (i.e., funniness perception of jokes) if any?

Facial expressions are direct indicators of personal emotions. Therefore, manipulating facial expressions should naturally elicit a strong effect on emotional feelings no matter what task is conducted, but it can be a different case with covert bodily manipulations. Although Duclos et al. (1989) built a relationship between body postures (i.e., anger posture) and specific emotions (i.e., anger), it can be accounted for by an embodied metaphor, such as ANGER IS SPECIFIC BODY POSTURE. For this reason, it is believed that different embodied metaphors would influence their corresponding abstract concepts, i.e., embodied metaphors of emotion would affect emotional feelings, and embodied metaphors of humor would instead affect humor appreciation. On account of this, we hypothesized:

Hypothesis to Q₃. Embodying common bodily metaphors of humor would not affect the participants' subsequent mood reports.

Study 1 (Textual Analysis Study)

Method

Humor-related texts were obtained from the online Chinese corpus built by the Center for Corpus Linguistics in Peking University (CCL corpus: http://ccl.pku.edu.cn:8080/ccl_corpus/). We first selected texts that contained the word *yōumò* 幽默 ('humor') as one part of our data (cf., Samermit & Gibbs, 2016). Next, following the method introduced in Müller (2015), the current study chose more laughter-related

texts (texts containing *xiào* 笑 ‘laugh/laughter/smile’) to represent humorous language for three main reasons. First, texts directly related to humor (e.g., jokes) are hard to identify and analyze with systematicity (i.e., even if texts contain the word *humor* may not necessarily be humorous texts). Second, laughter is a natural response to humor. For this reason, humor-related language and laughter-related language may frequently overlap with each other. Third, the word *humor* is translated as *yōumò* 幽默 in Chinese, which is only a transliteration of the English word *humor*. In fact, conventionally, the word *hǎoxiào* 好笑 (*hǎo* 好 ‘good’; *xiào* 笑 ‘to laugh/laughter/smile’) is more widely used in Chinese to describe somebody or something as hilarious. Therefore, the Chinese texts containing the word *xiào* 笑 (to laugh/laughter/smile) are closely related to humorous languages in Chinese.

Overall, several steps were followed for the selection and analysis of the data. First, the current textual analysis was based on the first 5,000 entries (out of 134,028) of *xiào* 笑 (to laugh/laughter/smile) and the first 1,500 entries (out of 5,662) of *yōumò* 幽默 (humor) in the CCL corpus. Considering the vast amount of data and the limitation of resources, a relatively small proportion of data was chosen for this textual analysis. Second, in order to find out whether there are body-involved metaphorical expressions of humor in these texts, body-part-related words were targeted because they could indicate the specific body parts involved and also the relevant bodily actions. Finally, the collected expressions were sorted according to their distinct features (i.e., in which way laughter is associated with the body) and were categorized into different embodied metaphor categories.

Results and Discussion

Varieties of embodied conceptual metaphors of humor were found in the Chinese CCL corpus. In accord with our expectation, universal bodily experience of humor contributes to a set of embodied humor metaphors similar to what was found in English and German (e.g., HUMOR IS FORCE), and unsurprisingly, some special humor metaphors were born by Chinese culture (e.g., HUMOR IS AN ENTITY). Four categories of embodied humor metaphors are classified, which are HUMOR IS FORCE, HUMOR IS SPECIFIC PERCEPTUAL SENSATIONS, HUMOR IS VISIBLE ON THE BODY, and HUMOR IS AN ENTITY. Examples and elaborations are given below.

The first category HUMOR IS FORCE describes how humor is experienced or perceived with the body. Specifically, humor is conceptualized as a force or an impact imposed on the body. Given that different sets of bodily experiences can be induced by the various intensity levels of the force of humor, the HUMOR IS FORCE metaphor can be further divided into two specific-level conceptual

metaphors, HUMOR IS BODILY MOTIONS (1*a-e*), and HUMOR IS PHYSICAL DISTURBANCE (2*a-f*). The former is typically featured with a relatively small force experienced by the body, and only causes bodily movements, such as placing hands on the belly (1*a*), leaning backward (1*b*), and curling up the whole body (1*c*). As the intensity of the force increases, the irresistibility of humor is amplified or exaggerated so that slight body movements turn into physical disturbance, which is manifested in the HUMOR IS PHYSICAL DISTURBANCE metaphor. For instance, the physical impacts of humor are sometimes perceived to be strong enough to knock one off his/her feet (2*a*) or even be able to split one’s sides (2*d*).

- 1*a*. 捧腹大笑, ‘to hold one’s sides; a belly laugh’
- 1*b*. 仰天大笑, ‘to laugh with the body leaning back’
- 1*c*. 笑成一团, ‘to laugh with the body curling together’
- 1*d*. 笑得前俯后仰, ‘to bend forward and backward because of laughter’
- 1*e*. 以幽默打动人心, ‘to strike one’s heart with humor’
- 2*a*. 被他们的哄笑击倒, ‘to be knocked down by their laughter’
- 2*b*. 笑得直不起腰, ‘to fail to stand up straight because of laughing’
- 2*c*. 笑得合不拢嘴, ‘to fail to close one’s mouth because of laughing’
- 2*d*. 笑破肚皮, ‘to split one’s sides laughing’
- 2*e*. 笑掉大牙, ‘to laugh one’s teeth off’
- 2*f*. 笑得喘不过气, ‘to lose one’s breath laughing’

In addition to the force experienced on the body, humor is also understood through senses, which brings about the second category HUMOR IS SPECIFIC SENSORY PERCEPTIONS metaphor. Under different circumstances, experiences of humor are also depicted distinctively varying from tastes of bitterness (2*a*), sweetness (2*b*), and spiciness (2*c*), to sensations of warmth (2*d*), coldness (2*e*), and dryness (2*f*).

- 2*a*. 苦笑, ‘a bitter smile (a wry smile)’
- 2*b*. 甜甜的笑容, ‘a sweet smile’
- 2*c*. 幽默里带有几分辛辣, ‘humor carries a taste of spiciness’
- 2*d*. 幽默的话语把大家的心都融化了, ‘words of humor melted everybody’s heart’
- 2*e*. 冷笑, ‘a cold smile (sneer)’
- 2*f*. 干笑, ‘a dry smile (a forced laugh)’

The third category HUMOR IS VISIBLE ON THE BODY accounts for how humor is rooted in the body, as some facial muscles and organs are good indicators of humor, such as mouth (3*a*), teeth (3*b*), eyebrows and eyes (3*c-d*).

Fig. 1 Embodied Metaphor Primes

3a. 嘴角挂着一丝笑, ‘a string of smile is hanging on the corners of the mouth’

3b. 笑齿瑳瑳, ‘smiling teeth are shining’

3c. 喜眉笑眼, ‘joyful eyebrows and smiling eyes’

3d. 眉开眼笑, ‘the eyebrows are stretching, and the eyes are laughing’

The fourth generic-level metaphor is HUMOR IS AN ENTITY, which was not reported in previous studies. It covers a couple of specific-level metaphors, such as HUMOR IS A TANGIBLE ENTITY (4a–b), and HUMOR IS AN TRANSFERABLE ENTITY (5a–d). These conceptual metaphors suggest that humor can also be treated as a concrete entity that is tangible or transferable, indicating that humor is sometimes conceptualized as a medium for one to interact with the rest of the world.

4a. 偷笑/嗤嗤窃笑, ‘to steal laughter (chuckle secretly)’

4b. 笑容可掬, ‘to hold the smile with both hands (a big smile)’

5a. 他把幽默送给别人, ‘he gave away humor to others’

5b. 沾染一身幽默细胞, ‘to be infected with cells of humor’

5c. 他的幽默将深深地感染和打动读者, ‘his humor will deeply infect and move the readers’

5d. 戏里的幽默传染了戏外的剧组人员, ‘casting people are infected by humor in the play’

To summarize, quite a few embodied metaphors of humor were found in the Chinese corpus, with some of which similar to the prior findings in English and German (i.e., HUMOR IS FORCE, HUMOR IS SPECIFIC SENSORY PERCEPTIONS, HUMOR IS VISIBLE ON THE BODY), probably owing to similar bodily experience, and some others peculiar to Chinese (i.e., HUMOR IS AN ENTITY) because of cultural and historical factors. According to Kövecses (2010, p.171), “universal physiology provides only a potential basis for metaphorical conceptualization”, with different cultures targeting “differential experiential focus” which brings about various conceptual metaphors.

Therefore, with varieties of humor metaphors found in the foreign and Chinese text, one thing is in common that they all indicate a close humor-body association which provides a solid foundation for the empirical study. In addition, as was indicated by the linguistic data, metaphors that are universal and common across languages could have rooted deeper in the direct bodily perceptions than otherwise, we therefore postulated that these metaphors (i.e., HUMOR IS FORCE) would induce a more profound effect of embodiment, and as such, they were chosen for the subsequent behavioral experiment.

Study 2 (Behavioral Study)

Method

Participants Eighty-one² students from Zhejiang University (42 females) consented to participate in the experiment in exchange for a monetary reward (20 RMB). Their average age is 23.8 years, ranging from 19 to 33. All participants were native Chinese speakers with normal or corrected-to-normal vision.

Design This experiment employed a single factor between-subject design. The participants were randomly assigned to one of three conditions, namely embodied metaphor prime, embodied non-metaphor prime, and no prime condition, with an equal number of participants per condition ($N = 27$). Embodied metaphor primes in the first condition are metaphor-based bodily cues, i.e., actions indicated by the embodied conceptual metaphors of humor. Three common idioms

² A power analysis for sample size estimation was conducted before the study using the software G*power 3.1 (Faul et al., 2009). Specifically, the desirable smallest sample size needed for the study is 66 participants in total, with an effect size of 0.40 (Cohen’s f , a large effect size according to Cohen’s criteria (1988)), a significance level of 0.05 and statistical power at 0.80. Therefore, 81 participants (more than 66) were recruited.

Fig. 2 Embodied Non-metaphor Primes

from the HUMOR IS FORCE metaphors were chosen as the embodied metaphor primes (Fig. 1), which are *pěngfù dàxiào* 捧腹大笑 (to hold one's sides laughing), *yǎngtiān dàxiào* 仰天大笑 (to laugh with the body leaning back), and *qiányǎng hòuhé* 前仰后合 (to bend forward and backward laughing). As the actions indicated by the idioms are compatible with each other, a series of smooth motions was created combining the meanings of the three idioms, which is 'holding one's belly while bending forward and backward repeatedly'. In contrast to the first condition, embodied non-metaphor primes (Fig. 2) were used in the second condition and implemented with the actions of 'turning one's upper body from side to side with both hands on the back'. These actions were designed to be similar to embodied metaphor primes in a way that both involve only the upper body with specific hand positions, to eliminate possible variants caused by the involvement of different body parts and discrepancies in energy consumption, etc. For the third condition, no action was required from the participants.

Procedure The experiment was carried out in a quiet environment. For the participants assigned to the first two conditions, they were instructed to watch a video in which a female demonstrator was performing a series of actions (embodied metaphor and non-metaphor primes as elaborated in Design). In the meantime, the participants were required to mimic and memorize the actions shown in the video. Accompanying the actions, there were explanatory notes of the actions on the left corner of the screen. If the actions were done incorrectly, the experimenter would offer extra guidance to make sure the participants move their bodies in the metaphor- or non-metaphor-based way. Next, the participants were given a short practice period of 30 s to familiarize themselves with the actions. In the formal experiment, the participants were required to perform the set of actions they learned eight times, with static pictures of the actions being presented on the laptop screen for them to refer to. The speed of their movements was roughly controlled

by numbers (1 to 8) on the screen. Every six seconds, the number would accumulate, which notified the participants that the following round of actions should start. Immediately after the actions, the participants would receive two paper-based questionnaires with one consisting of 20 jokes and the other a Chinese version of the PANAS (Positive and Negative Affect Schedule) mood scale (Watson et al., 1988). They were instructed to start with rating the funniness level of the jokes on a five-point Likert Scale, ranging from 1 (not at all) to 5 (very funny). After that, the participants should rate their mood at that moment on a five-point Likert Scale, ranging from 1 (very slightly or not at all) to 5 (extremely). For the participants assigned to the third condition, no actions were required, and they only needed to fill in the two questionnaires on jokes and mood.

Materials The jokes were selected from a few Chinese online portals. A pretest was conducted to control the funniness level of the jokes adopted in the experiment. Eighty-two students from NingboTech University voluntarily took part in rating the jokes using a five-point Likert Scale, ranging from 1 (not at all) to 5 (very funny). Twenty jokes which average scores equaled to or higher than 3.00 were adopted, ranging from 3.00 to 3.46, with an average length at 53.05 characters. A sample of the jokes is shown in Table 1.

Results

Funniness Rating on Jokes Reliability analysis was carried out on the joke questionnaire comprising 20 jokes. Cronbach's alpha showed that the questionnaire had good internal consistency ($\alpha = 0.831$). With three conditions of different embodied primes serving as the between-subject independent variable and funniness ratings of jokes as the dependent variable, both by-subject and by-item analyses were conducted in SPSS (Version 24.0).

Table 1 A Sample of adopted jokes

Chinese version	English version
之前有个老妹儿问我借一大笔钱去整容, 整的挺成功的——我再也认不出是谁问我借钱了。	Once a friend of mine borrowed a good fortune from me to do plastic surgery, which was a success... I could never recognize who on earth borrowed my money (after the surgery).

In the by-subject analysis, the joke ratings of each participant were averaged. No data were discarded from analyses since all of them are within three standard deviations of the mean. Shapiro–Wilk tests indicated all data in each of the three conditions were normally distributed (all $p \geq 0.072$) while Levene’s test showed heterogeneity of variances ($p = 0.036$). Therefore, Welch’s ANOVA was used in the by-subject analysis, and the level of significance was denoted by $\alpha = 0.05$. There was a significant difference across conditions (Welch’s $F(2, 50.01) = 4.14, p = 0.022$). Follow-up pairwise comparisons were conducted with the Games Howell post hoc test, which revealed a significant difference between the embodied metaphor prime condition and the no prime condition ($p = 0.029$), with no significant difference occurring between the embodied non-metaphor prime condition and other conditions.

In the by-item analysis, the ratings for each joke among all participants were averaged. All data lay within three standard deviations of the mean. Shapiro–Wilk tests revealed that the dependent variables in no prime condition did not obey the normal distribution ($p = 0.037$). As a result, Kruskal–Wallis one-way ANOVA was administered in the by-item analysis. The main effect of the condition was significant ($H(2) = 24.823, p < 0.001, \epsilon^2 = 0.42$). The effect size ϵ^2 turned out to be 0.42, which is a large effect size in psychological studies, indicating a robust effect of the by-item analysis. The subsequent Dunn’s post hoc test with Bonferroni adjustment on pairwise comparisons revealed a significant difference between the embodied metaphor prime and the embodied non-metaphor prime conditions ($p = 0.005$) and between the embodied metaphor prime and the no prime conditions ($p < 0.001$). No significant difference was found between the embodied non-metaphor prime condition and the no prime conditions ($p = 0.240$).

In short, there is a robust effect of condition (i.e., between with or without embodied metaphor primes) both in the by-subject and by-item analyses. In the pairwise comparisons, the participants rated the jokes as higher on funniness level in the embodied metaphor prime condition than the non-metaphor prime condition, but significant difference was only found in the by-item analysis; When comparing embodied metaphor prime condition and no prime condition, both by-subject and by-item analyses showed significant difference; As for the non-metaphor prime and the no

prime conditions, no significant difference on joke ratings was spotted in either analysis.

Mood Rating The coefficient alpha of the two subscales on positive and negative affect from PANAS were 0.846 and 0.910 respectively, which indicated that the mood scores were highly reliable. The participants’ mood ratings were calculated by subtracting the total negative affect scores from positive affect ones (cf. Schaefer et al., 2018). No data were excluded as they were all within 3 standard deviations of the mean. The mood ratings of all three conditions were normally distributed (all $p \geq 0.320$), and homogeneity of variances was determined by Levene’s test ($p = 0.079$). Therefore, one-way ANOVA was performed on the mood ratings. There were no statistically significant differences between group means ($F(2, 78) = 0.464, p = 0.631$).

General Discussion

The current research is dedicated to figuring out the humor-body association. In specific, we focus on the question of whether and how humor appreciation is shaped by concrete bodily experience. Through two complementary studies, a textual analysis study and a behavioral study, three major findings are obtained. First, embodied conceptual metaphors of humor are found pervasive among Chinese humor- and laughter-related languages. Second, embodying humor metaphor primes result in higher joke ratings as compared to embodying non-metaphor primes or not embodying any prime, as suggested by the by-item analysis. Third, mood levels are not found improved by any embodied prime.

Embodied Conceptual Metaphors of Humor Do Exist in Chinese The first finding accords with our expectation to Q_1 as a variety of embodied conceptual metaphors of humor are found in common Chinese expressions and idioms. Some of these conceptual metaphors are similar to what was found in English and German (Gibbs et al., 2018; Müller, 2015; Samermit & Gibbs, 2016), namely, HUMOR IS FORCE, HUMOR IS SPECIFIC SENSORY PERCEPTIONS, HUMOR IS VISIBLE ON THE BODY, and HUMOR IS AN ENTITY. These metaphors mainly resort to concrete and specific bodily experience (i.e., bodily feelings of force

and perceptual sensations) in conceptualizing humor, which, on the one hand, complies with the proposition made by Johnson (1987) that the embodied experience is behind metaphorical thinking, and on the other hand, confirms our assumption that the similar set of embodied humor metaphors among different languages stems from shared bodily basis and experience. As for those conceptual metaphors unique to the Chinese language, such as HUMOR IS AN TANGIBLE ENTITY and HUMOR IS AN TRANSFER-ABLE ENTITY, they describe how humor is understood through bodily interaction with the world. As how one interacts with the world can be largely shaped by cultural and historical reasons, the differences in behavioral style or experiential basis in turn lead to the formation of conceptual metaphors with various “experiential focus” (Kövecses, 2010) in different languages or cultures. On the whole, either type of embodied humor metaphors found in Chinese corpus is built from a solid bodily basis, and the extensive use of such metaphors in Chinese indicates that the embodied humor representation could be a universal phenomenon.

Humor is Perceived Through Embodied Conceptual Metaphors The second finding on joke ratings uncovers that one’s ability to perceive humor can be improved by doing specific actions related to embodied humor metaphors. Specifically, the embodied humor metaphors enable one to retrieve former funniness experience through doing specific actions denoted by the metaphor, and the reactivated funniness experience in turn enhances one’s ability to appreciate humor. To note that this finding is mainly supported by the by-item analysis in the behavioral experiment, which revealed remarkably higher participants’ ratings on jokes if primed with metaphor-based bodily cues than otherwise; while in the by-subject analysis, no significant difference in joke ratings is found between the embodied metaphor and the non-metaphor prime conditions, which may be due to the limited number of participants in the current study. In general, this finding is consistent with our hypothesis and also the previous findings. For elaboration, Samermit and Gibbs (2016) found the participants were better at humor production (i.e., producing funnier cartoon captions) after the embodied humor primes (i.e., manipulating one’s body in the way that is indicated by embodied metaphors of humor); Kaspar et al. (2016) suggested that implicit metaphor-based bodily cues of weight would influence the participants’ humor experience on cartoons, especially for the female participants.

It is also noteworthy that there is no significant difference in joke ratings between the non-metaphor prime and the no prime conditions. On the one hand, it is in accordance with the findings from Kaspar (2013), which pointed out that when there is no metaphorical mapping between concrete and abstract concepts (e.g., weight sensation and recovery

time of a disease), the concrete sensorimotor experience would not exert any effect on the processing of abstract concepts, which ruled out the possibility that embodied metaphorical mappings between concepts are superfluous, that is, not any random actions without embodied mappings could lead to the increased joke ratings. On the other hand, it helps clarify that the higher ratings of jokes in the embodied metaphor condition were not ascribed to a sense of absurdity caused by bodily actions, as both metaphor and non-metaphor conditions required actions from the participants. Overall, this finding not only infuses new blood to the scarce literature on embodied humor research by demonstrating how humor and body are connected through embodied metaphors, but also sheds light on the conceptual metaphor accounts of abstract reasoning (Gibbs et al., 1994; Gibbs, 2006; Lakoff & Johnson, 1980) by providing empirical evidence from a relatively new angle of humor appreciation, an understudied abstract concept.

Only a Casual Role of Mood is Found in Humor Appreciation The third finding that mood ratings did not significantly differ across conditions can be interpreted in the following two ways. One probable interpretation is that mood level was indeed not influenced by any bodily cues implemented in the current study, neither metaphorically nor non-metaphorically, suggesting that the influence in humor appreciation is not owing to the reactivated emotional experience associated with those bodily movements. This interpretation is in keeping with our hypothesis and again attests to the second finding as it highlights that embodied humor metaphor alone enhances the humor experience. However, the contrasting opinion suggested by Strack et al. (1988) insists that facial manipulations only operate on emotional experience and the increased funniness ratings of humorous stimuli are only “side effects” of the lifted emotional states instead of an outcome of facial manipulation. In fact, if the seemingly contradictory findings by Strack et al. (1988) are examined under the embodied metaphor account, a different story can be told. Manipulation of facial expressions can be regarded as one way of embodying emotion metaphor, such as EMOTION IS VISIBLE ON THE FACE (e.g., *xǐ shàng méishāo* 喜上眉梢, *Lit.* joy appears on the eyebrows; *Met.* very happy). In this regard, it is justifiable for Strack et al. (1988) to find an emotional elevation by a smile-like facial expression, as is supported by the facial feedback hypothesis (Izard, 1990; McIntosh, 1996); While in our case, the specific embodied metaphor applied in the current study intended only to build the bridge between body and humor rather than emotion, that is why no emotion was targeted or expected to be evoked by the specific bodily postures and therefore the mood level remained unchanged.

Alternatively, since mood was rated after jokes, it is also possible that those bodily manipulations temporarily raised

the participants' emotions but the effect was short-lived so that it failed to emerge on the final mood ratings. Tracing back to the linguistic evidence, some metaphorical expressions of emotion and body can also be spotted. For example, *qíng bú zì jīn* 情不自禁 means being unable to restrain one's emotions or being overcome by one's feelings; *xǐ bù zì shèng* 喜不自胜 connotes being unable to contain one's joy. Underlying these Chinese idioms, conceptual metaphors such as EMOTION IS FORCE can be summarized. As the EMOTION IS FORCE metaphor is similar to the HUMOR IS FORCE or HUMOR IS SPECIFIC BODY POSTURE metaphor, bodily cues applied in the current experiment also had a chance of inducing specific emotional feelings. This view can be partially supported by Zhao et al. (2016), in which the researchers posited that there was a metaphorical relation between weight and emotion. For example, in their Experiment 1, they found participants tended to make faster judgments if the positive emotional words appeared on the same side of a balance with an object of lighter weight (i.e., the weight of a smaller stone), suggesting a positive-lightness metaphor. If so, emotions like humor may also have roots in bodily perceptions through embodied metaphors.

Nonetheless, there is no evidence that the exact metaphor-based bodily cues (i.e., to hold one's belly while bending forward and backward repeatedly) incorporated in the behavioral experiment is directly related to any metaphors related to emotion even though some embodied emotion metaphors do exist in common expressions. Moreover, it is important to note that even if the existence of embodied metaphors of emotion can be partially justified by empirical and linguistic evidence, no emotional activation was found in the current study, and only if the effect on emotion is actually transient, can this interpretation be reckoned true. Furthermore, most participants completed the joke rating task within a short period of fewer than five minutes. It is therefore a reasonable supposition that the participants' mood level was steady and stable throughout the process of the behavioral experiment. In sum, on every account mentioned above, there is no direct evidence found in the current study supporting the view that humor appreciation is affected by emotional experience.

Summary The present study enlarged the existing literature on abstract reasoning by exploring the embodied nature of humor from the perspective of conceptual metaphors. It provides clear linguistic and empirical evidence on the significant role of embodied metaphors in humor appreciation, with additional ratings of emotional mood to exclude the potential complication. Given that a large body of literature supporting bodily conceptualization mainly focused on such abstract concepts as time, quantity, power, etc., still little is known about how humor is experienced under an embodied cognition account, especially in the Chinese context. Therefore, this study took on the mission to offer empirical

verification of embodied humor as experienced by Mandarin Chinese speakers. We started with a textual analysis study that provided convincing linguistic evidence of the extensive use of embodied humor metaphors in Chinese. It lends support to previous humor research in English and German and demonstrates that understanding humor through embodied metaphors could be a universal cognitive process. The follow-up behavioral experiment optimizes this investigation with empirical data which further verifies the linguistic data and consolidates the role of metaphor in humor processing. With the final arrangement of mood ratings, an important message is delivered that emotion probably only plays a trivial role in humor processing, though further research is needed in this respect.

Despite all that was achieved with the current study, a few limitations remain. Firstly, the scale of the textual analysis is relatively small because of the extremely large number of entries of *xiào* 笑 (to laugh/laughter/smile) in the corpus and the limitation of resources for the study. As a result, the authors may not be able to exhaust all possible types of embodied humor metaphors in Chinese. Future inquiries are needed for better coverage of the corpus data. Secondly, the number of participants in each condition is limited, which might explain why there was no significant difference found between embodied metaphor and non-metaphor prime conditions in the by-subject analysis though a strong effect is revealed by the by-item analysis. Thirdly, the current experimental design is not enough to account for the role of emotion in the process of humor understanding. Future studies are suggested to arrange more control groups to rate the mood right after the embodiment of the actions so that a clearer picture can be drawn on the body, humor, and emotion association. Lastly, the current study used the PANAS scale to measure the mood state of the participants. Though it has been proved to be a reliable and valid measure of mood, it only provides a relatively broad assessment of mood in general. For future studies which focus mainly on the positive mood caused by humor in specific, making use of some other humor-targeted mood rating scales (e.g., the State-Trait Cheerfulness Inventory, Ruch et al., 1996; the Sense of Humor Scale, McGhee, 1996; cf. Ruch, 1998) may help obtain more precise results than the current study.

Conclusion

Based on a corpus-based textual analysis and a behavioral study, the present study provides clear linguistic and empirical evidence on the significant role of embodied metaphors in humor appreciation, with additional ratings of emotional mood to exclude the potential complication. In specific, linguistically, a considerable number of embodied humor

metaphors are found in common Chinese expressions which are supplementary to previous data in English and German, suggesting a universal bodily basis of humor appreciation. Empirically, embodying actions indicated by embodied humor metaphors are able to intensify one's humor experience with mood playing a probable casual role in the process. The study not only contributes to the understanding of embodied cognition from this relatively new perspective of humor appreciation but also serves as a pioneer work in Chinese humor research from a psycholinguistic perspective, which, in the broad sense, helps promote the theoretical advancement of embodiment theories as well as Conceptual Metaphor Theory in general.

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Data Availability All data generated or analysed during this study are included in this published article.

Declarations

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

Conflict of Interest The authors declare that they have no conflict of interest.

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