Show your teeth or not: The role of the mouth and eyes in smiles and its cross-cultural variations

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In describing the processes that contribute to the meaning of a perceived smile, Niedenthal et al. astutely capture the complex nature of emotion processing. We applaud the approach taken by the authors in the current article: Embodied perspectives on cognition are in need of exactly such a detailed investigation of the interaction between conceptual and embodied knowledge. The question is not *whether*, but *how* sensorimotor processes and cognition interact (e.g., Fodor 1985) The SIMS model illustrates how embodied responses to facial emotional expressions facilitate recognition of these expressions. We believe, however, that a SIMS model that explicitly addresses the dynamic interaction between conceptual and embodied knowledge would provide an even more useful framework to develop and test specific predictions.

Given that an embodied response to smiles (e.g., motor activation in the facial muscles) emerges around 500–1000 msec after observation of a smile (Dimberg & Petterson 2000; Dimberg et al. 2000), it seems important to integrate more rapid cognitive processes in the SIMS model. First, before a smile is even observed, contextual information might play an essential role in determining which brain areas are activated when eye contact is established (e.g., OFC activation when talking to a loved one), and therefore, the type of smile that is expected. Second, the evaluative connotation of a smile and more specific conceptual information are activated rapidly at the moment that a smile is observed (within 120 msec, Ruys & Stapel 2008b; see also Palermo & Rhodes 2007).

Considering that information processing occurs as efficiently as possible, it seems unlikely for embodied simulations to emerge for the purpose of recognition when associative knowledge structures rapidly enable the recognition of functional smiles. Although Niedenthal et al. acknowledge that contextually driven, rapid processing occurs, they also argue that in many circumstances embodied simulations allow observers to infer the correct meaning of ambiguous smiles, when conceptual or stereotypical knowledge would lead to errors of interpretation.

Two possible mechanisms may cause activation to occur of the different brain areas that allow people to distinguish between affiliative, enjoyment, and dominance smiles. The first possibility is that these three types of smiles have unique and distinguishable motor patterns. Assuming that an observer correctly simulates the observed smile, different patterns of brain activation lead to somatosensory activation that matches the observed smile, which subsequently facilitates the correct recognition of the smile's meaning. However, the possibility of unique motor patterns for these three types of smiles is not what Niedenthal et al. seem to advocate, and this idea lacks empirical support.

The second possibility is that rapidly activated contextual and conceptual information guides and constrains the embodied responses that emerge when observing a smile. Indeed, "happy" or "angry" conceptual information has been shown to lead to the activation of different facial muscles when observing identical faces with ambiguous facial expressions (Halberstadt et al. 2009). When a baby produces a smile with an unclear meaning, observers are unlikely to interpret the smile as a dominance smile, given that conceptual knowledge informs us that babies do not express dominance smiles. Niedenthal et al. might argue that in such a situation, where the exact meaning of the smile is ambiguous, conceptual knowledge of smiling babies will provide the *possible* meaning of the smile. It is exactly this interplay between conceptual and embodied information in determining the meaning of smiles that we propose deserves attention in the SIMS model.

As a further example, take the orbitofrontal cortex (OFC) activation which occurs when perceiving smiles from one's own offspring (compared to seeing other people's smiling offspring). OFC activation may help to distinguish between our own and other people's offspring *and* to distinguish between affiliative and enjoyment smiles. For OFC activation to be able to distinguish between an affilitative and enjoyment smile from our own children, the OFC needs to be differentially activated when we see our own children smile different functional smiles. Although this is an empirical question, the current literature suggests the OFC is activated when seeing our offspring display any emotional reaction, such as smiling, but also crying (Noriuchi et al. 2008). We believe the SIMS model needs to incorporate the interaction between contextual conceptual information and embodied simulation to account for how people differentiate between the different meanings of functional smiles.

What is the function of the embodied simulation of an affiliative smile, when contextual conceptual information and rapid evaluative processing can often determine the meaning of such a smile much more efficiently? We believe that a SIMS model that goes beyond the passive observer can provide an answer by examining the role embodied simulations play in the social dynamics in which smiling behavior typically occurs. The simulation of smiles is not only a motor process that contributes to understanding, but also a process that serves a communicative function (Ruys & Stapel 2008a) involving social cognitive mechanisms (Schilbach et al. 2008).

As described by Niedenthal et al., social contextual variables can sometimes inhibit the simulation of an observed smile. Indeed, the automatic imitation or representation of the actions of others has been shown to be moderated by social information (e.g., Longo & Bertenthal 2009; Ruys & Aarts, in press; van Baaren et al. 2003). Although speculative, OFC activation and rapid processing of the evaluative connotation of a smile may together determine whether social inhibition of the motor simulation occurs or not. By determining whether corresponding somatosensory experiences are produced on a dyadic level, embodied simulations can contribute to the meaningfulness of social interactions (e.g., Parkinson 1996).

Understanding the meaning of smiles can be further determined by a range of bodily and cognitive factors, such as the observer's somatosensory experience at the time a smile is observed, or the observer's expectations and goals. We believe that understanding is an emergent process, which is guided and constrained by the dynamic interaction between embodied and conceptual information (see also, Mesquita et al. 2010). Specifying this interaction should be the focus of future theoretical and empirical work.

Show your teeth or not: The role of the mouth and eyes in smiles and its cross-cultural variations

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Abstract: Previous studies with Westerners have found that both the mouth and eyes are crucial in identifying and interpreting smiles. We proposed that Easterners (e.g., Chinese and Japanese) evaluate the role of the mouth and eyes in smiles differently from Westerners. Individuals in collectivistic Eastern society heavily rely on information from the eyes to identify and interpret the meaning of smiles.

A major potential limitation of the SIMS model is, as authors Niedenthal et al. have explicitly stated, "*The SIMS model has been largely developed using data collected in Western countries. Nevertheless, it is essential to note that cultural differences may modulate our account*" (sect. 6, para. 3, emphasis ours). Here we echo this proposal and discuss how people in Eastern cultures

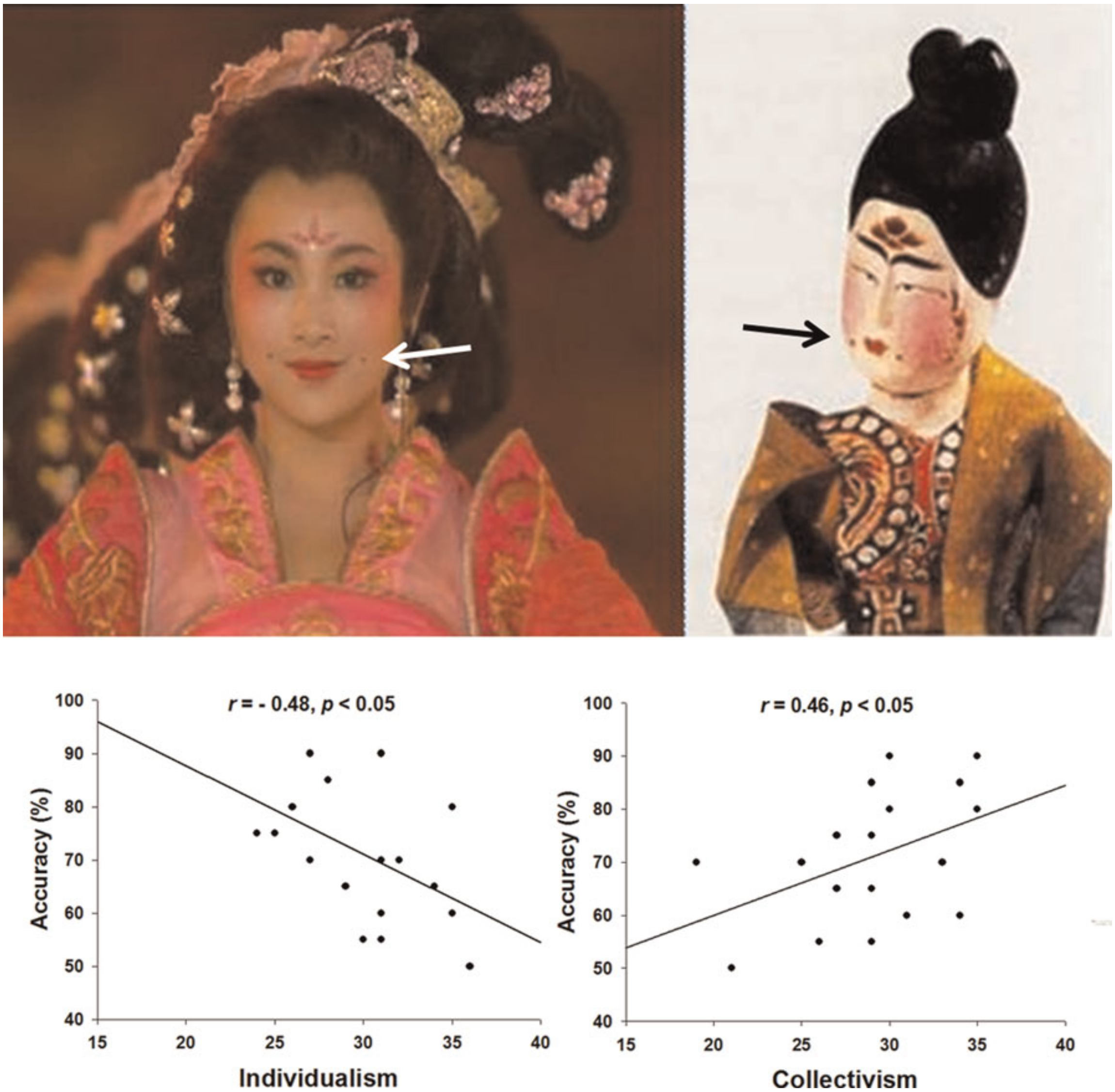

Figure 1 (Liu et al.). **Top**: Ancient Chinese women used fake dimples to embellish their closed-mouth smiles (Xinhuanet 2008). **Bottom**: Chinese participants who focused on the eyes in a real versus fake smiles identification task showed a negative correlation between accuracy and individualism scores, but a positive correlation for collectivism scores.

differently evaluate the role of the mouth and eyes in smiles, and how such variations might modulate the SIMS model.

In the target article, the authors concentrate on the eyes and eye contact; however, in Western cultures, the mouth is as crucial as the eyes in identifying and interpreting facial expressions, especially happiness. The most unequivocal evidence comes from patient S.M., who has severely impaired detection of anger and fear after losing the bilateral amygdala, but still maintains an entirely normal identification of happiness (Adolphs & Tranel 2000; Adolphs et al. 1994). This dissociation is due to his inability to use information from the eyes but an intact ability to use information from the mouth (Adolphs et al. 2005). It therefore provides direct evidence that the mouth alone could supply sufficient information for the recognition of happiness and smiles, which has also been confirmed by the computational analysis of FACS-coded faces (Smith et al. 2005). The second vein of evidence derives from facial mimicry and the mirror neuron system. Facial mimicry is critical in constructing embodied simulations for smiles, and thus plays an important role in the SIMS model, yet the majority of studies on facial mimicry manipulate only the mouth and related zygomatic muscles (Blairy et al. 1999; Maringer et al., in press). In addition, mimicry and embodied simulation have been closely linked to the mirror neuron systems (Keysers & Gazzola 2007), whereas studies of the mirror neuron system are essentially focused on actions from the mouth and hands, such as drinking, eating, and grabbing (Iacoboni et al. 1999; 2005). Thus, it is not surprising that in the SIMS model, the mouth is the apt alternative of the eyes for observers in the social inhibition condition (see Figures 5 and 6 of the target article).

However, so far most data have been collected from Western cultures. There is evidence that Easterners evaluate the role of the mouth and eyes differently from Westerners. For example, "do NOT show ones' teeth when smiling" was a strict rule of discipline for ancient Chinese women, who even used adornments (e.g., fake dimples) to make up for the scarcity of emotional information conveyed by the mouth during their closed-mouth smiles (see our Fig.1, Top). Another example is the smile emoticons used by Easterners and Westerners. While Westerner use emoticons exaggerating the mouth with a crimped line and simplifying the eyes as two dots, e.g., :-) or :), Japanese use emoticons with simplified mouth but crimped eyes, e.g., (^.^) or (^_^) (Jack et al. 2009; Pollack 1996; Yuki et al. 2007). Chinese, especially females, go even further by evoking the ancient tradition of attaching fake dimples, for example, (*^_^*) (Marshall 2003).

Such a cross-cultural difference has been replicated in experimental research. In two studies using emotional expressions in emoticons or computer-edited photographs of real faces, Yuki et al (2007) compared the difference between Japanese and Americans in weighing facial cues when interpreting emotional expressions. Results showed that Americans weighed expression cues displayed in the mouth more when judging emotions, whereas Japanese tended to weigh expression cues in the eyes heavily. In a recent eye-tracking study investigating the decoding of facial expression signals in a facial expression categorization task, Jack et al (2009) found that Easterners and Westerners adopt different decoding strategies when reading others' facial expressions. Westerners distributed their fixations evenly across the face, whereas Easterners systematically biased their fixations toward the eyes and ignored the mouth. In our study (Liu et al., under review), we found that when asking Chinese speakers to judge the Duchenne and non-Duchenne smiles as either real or fake (Bernstein et al. 2008), those who voluntarily stated the eyes to be the most useful source of information are more accurate (mean $= 71.11 \pm 12.31\%$) than those who preferred the mouth (mean $= 62.89 \pm 11.34\%$), $p < .05$. More interestingly, the accuracy of participants preferring the eyes is negatively correlated with individualism scores, but positively correlated with collectivism scores (Fig.1, Bottom), indicating that individuals in a collectivist society heavily rely on information from the eyes to identify and interpret others' facial expressions and social intentions.

How could these Eastern culture data modulate the SIMS model? We propose two possible modifications. First, how do Easterners, as highly dependent on the information from the eyes, cope with the social inhibition situation when eye contact is not available? One interpretation for these cross-cultural differences is that Easterners are good at regulating facial expressions because of the restriction of expressing individual emotion in public, especially for those expressions originating from the mouth, because it is much easier to control than the eyes. Consequently, Easterners usually do not trust what they read from others' mouths (Yuki et al. 2007). If this were true, we might expect to find that Easterners could search for supplemental information from other relatively uncontrollable sources (e.g., body language) when the eyes are unavailable, rather than still relying on those controllable sources (e.g., mouth) as Westerners do, according to the SIMS model. Second, how could the systematic underrating of the mouth in reading and decoding others' facial expressions influence Easterners' facial mimicry ability and mirror neuron system? Would an Eastern "patient S.M." lose the ability to recognize happiness because of an inability to decode the eyes? Future cross-cultural neuroimaging studies of the differences in positive emotions thus are very promising.

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Motivational aspects of recognizing a smile

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Abstract: What are the underlying processes that enable human beings to recognize a happy face? Clearly, featural and configural cues will help to identify the distinctive smile. In addition, the motivational state of the observer will influence the interpretation of emotional expressions. Therefore, a model accounting for emotion recognition is only complete if bottom-up and top-down aspects are integrated.

Most of the research on facial expression has focused on negative emotions, such as anger, fear, or disgust (e.g., Adams et al. 2003; Mathews et al. 2003; Putman et al. 2006), while positive emotions have received relatively less attention. The attempt to examine the nature of smiles by Niedenthal et al. is therefore highly welcome. To assist with further development of SIMS, we highlight its omission of observer bias and the importance of measuring the time course of motor resonance.

Niedenthal et al.'s proposal as to how a smile may be processed by an observer is rather one-sided. Importantly, they do not take into account the observer's motives and suppositions. As the authors point out, analysis of the facial features may not always be sufficient to classify realistic emotional expressions, and then the perceiver must call on alternative sources of information, such as the social situation in which the expression occurs. More than that, the perceiver will evaluate and interpret the expression on the basis of his or her emotional state and desires. Specifically, if an observer is in a happy mood, then an emotion expressed by another person will be interpreted differently compared to when the observer is sad or angry.

According to the affect-as-information theory (e.g., Schwarz 1990), mood is used to make social judgments. When a person is in a certain mood, he or she may inadvertently attribute that mood state to other people, which in turn will influence the interpretation of an observed facial expression. In fact, Niedenthal herself (Niedenthal et al. 2000) found an effect of emotional state in a task where participants had to detect at which frame of a movie a facial expression (e.g., happiness) became neutral. When the participant's mood was congruent with the initially displayed emotion, this expression was perceived to persist longer than when participant mood and initial stimulus expression were incongruent. Hence, a happy person will more readily interpret emotion is not too extreme).a given emotional display as happy (at least as long as the displayed

In the 1950's psychologists argued that what we perceive is influenced by our motivations or "set" (the so-called "New Look"). For example, the size of more valuable coins was overestimated, and hungry participants were quicker than satiated participants to identify food-related words (for critical discussion, see Erdelyi 1974). Applying this insight to our point about observer bias, basic motivational tendencies, such as what we wish to see, might also influence the recognition of smiles. Supporting this claim, we recently found a self-referential positivity bias when judging where another person is looking (Lobmaier & Perrett, in press; Lobmaier et al. 2008). People expressing a happy emotion were much more likely to be interpreted as attending to the observer than were people with an angry or sad expression. It is beneficial for our self-esteem to assume that we are the reason for somebody else's happiness. Thus, in the context of the SIMS model, expressions may be interpreted as more positive, just because this is what we wish the expression to be: not only will we perceive a smile as directed to us, we might also interpret a facial expression to be more positive than it really is.

The SIMS model explains recognition of smiles as a mainly stimulus-driven process. This approach is in contrast with various current models of emotion recognition. For example, the appraisal model of emotion (e.g., Scherer 2001) postulates that stimuli undergo evaluation checks on the basis of various dimensions: novelty (is a stimulus novel, predictable?), intrinsic pleasantness (positive or negative evaluation), goal significance (is it relevant to pursue my goal?), coping potential (can I deal with it?), and compatibility with social or personal standards (is it acceptable for me and others?). In the context of happy emotions, this means that (unconscious) cognitive evaluation of