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The role of language in emotion: existing evidence and future directions

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In this manuscript, I briefly outline contemporary psychological constructionist approaches to the study of emotion, which hypothesize that language is an 'ingredient' in the creation of emotional perceptions and experiences. I then review recent neuroimaging, behavioral, and lesion evidence that emotion words ('anger,' 'disgust,' 'fear') are crucial to the perception and experience of emotions. Finally, I look to future directions for more causal evidence that language is important in emotion.

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Language and emotion are certainly linked — humans use words to describe how we feel in spoken conversations, when thinking to ourselves, and when expressing ourselves in writing — but is the relationship between language and emotion more than unidirectional? Multiple psychological and neuroscientific models of the mind hypothesize that the answer is 'yes' (see Box 1). In the literature on emotion in particular, *psychological constructionist* approaches suggest that the words that people know (e.g. 'anger,' 'disgust,' 'fear') serve as predictive models for how people make meaning of sensations as perceptions and experiences of specific emotions in a given context [11••,12••,13••,14••]. Other contemporary models of emotion are either agnostic about the role of language in emotion [15] or argue that language only interacts with emotion because it serves as a stimulus that elicits emotions [16] or as a communication device that labels emotions after the fact [17]. However, according to the psychological constructionist view, emotion words, and the concepts that they name, are hypothesized to be critical 'ingredients' in creating perceptions and experiences of emotion in the first place.

Psychological constructionist views suggest that language is necessary, but not sufficient, for perceptions and experiences of emotion. In these views, emotions are the combinations of multiple basic 'ingredients,' including, but not limited to, concept knowledge that is supported by language. Another essential ingredient is the perception and experience of affect [18–22]. Whereas 'emotions' (e.g. anger) are discrete states experienced as having certain subjective feelings (e.g. unpleasantness, high activation, blood pumping, a flushed face), objects (e.g. a colleague's rude comment, a blocked goal), and action orientations (e.g. a need to retaliate, a scowl, an insult), affect is a very general feeling of pleasure or displeasure [19,23,24]. Language is not thought to be necessary for these basic affective experiences [22,24]. Unlike 'emotions,' affect is likely experienced across species (see Bliss-Moreau, this issue) and exists early in human development (Camras and Halberstadt, this issue). Thus, in the absence of language an organism can still experience pleasure and displeasure. Rather, psychological constructionist views argue that language is essential to transform very vague sensations of pleasure and displeasure into a discrete and specific type of emotion (e.g. an experience of anger versus fear [25]; a perception of someone else as angry versus fearful [26]).

Building on psychological constructionist theory, the goal of this article is to briefly evaluate recent evidence for the hypothesis that language is an important 'ingredient' in emotion (for more extensive recent reviews, see [11••,12••,13••,27]). I focus mainly on very recent literature, starting with the most circumstantial, correlational evidence, and ending with the most causal, experimental evidence for the role of language as an 'ingredient' in emotion.

Brain regions supporting language are involved in emotion: correlational neuroscience evidence

Correlational findings from neuroimaging studies of emotion are a useful tool for examining whether brain regions typically associated with language, and semantic processing in particular, are also involved during emotions. Indeed, when comparing findings from a neuroimaging meta-analyses of semantic judgments [3] and a neuroimaging meta-analysis of emotional experiences and perceptions [28], we found areas of significant spatial overlap [12••]. The brain regions implicated in both semantics and emotion included regions classically associated with semantic representation and retrieval [4,29] such as the

Box 1 Other approaches arguing for a role of language in conscious experience

Psychological constructionist views are not alone in their recognition of the power of language in shaping mental states. There are many models in cognitive science that recognize the interaction of language and concepts in shaping cognition, including the idea that abstract concepts are represented by collections of prior experiences that are linked by words [1–4], the idea that words are especially crucial in helping children to acquire concepts [5], and the idea that sensory and conceptual information interact and mutually shape one another during the construction of conscious experiences (e.g. as in visual perception [6,7,8••]). More generally, models of conscious experiences that hypothesize a role for prediction [8••,9,10] (Wilson-Mendenhall, this issue) in constructing on-going experiences either implicitly or explicitly posit a role for concepts in shaping how the brain makes meaning of on-going sensory experiences. It is beyond the scope of this review to fully discuss psychological constructionist approaches to emotion, predictive models of the brain, and the mutual relationship between language and concepts, but for recent discussions, see [8••,11••,14••].

left ventrolateral prefrontal cortex (vlPFC), bilateral lateral temporal cortex (lTC), and dorsomedial prefrontal cortex (dmPFC). The anterior temporal lobe, another region classically linked to semantic representation via neuropsychological findings [30] is also notably involved during emotion [28,31,32], although it appears less frequently than some of these other regions in neuroimaging findings due to scanner artifacts.

Individual neuroimaging studies even more clearly suggest a dynamic role for the vlPFC, lTC, dMPFC, and ATL in emotion by suggesting that these regions interact with regions well known to generate and represent affect (e.g. the amygdala and insula [23]) during the creation of emotional perceptions and experiences. These findings are consistent with the psychological constructionist prediction that language and affect both serve as important 'ingredients' in emotion. For instance, one study [33] suggested that during emotions, dmPFC may be especially relevant for attending to and integrating conceptual knowledge to make meaning of one's affective state. In contrast, vlPFC is associated with retrieval of semantic concepts for categorizing emotional experiences as discrete states. Crucial to the constructionist hypothesis, another recent study [34••] implies that this labeling process does not just occur post hoc, once the emotion is already created. Instead, the act of labeling your own or someone else's emotions with words appears to feedback to alter how the brain is representing the affective 'ingredient' of the emotion in the first place. Labeling emotions with words increases activity within the amygdala (involved in generating affective responses in the body) and the insula (involved in representing affective changes in awareness) [34••]. This increase in activity within the amygdala during labeling is also associated with greater functional connectivity between the amygdala and a more ventral aspect of medial prefrontal cortex (vmPFC) [34••], which is also implicated in semantics [3].

Consistent with a psychological constructionist view, the fact that labeling increases amygdala and insula activity as well as causes positive correlations between vmPFC and amygdala suggests that labeling may actually increase the intensity of an emotional response. Indeed, two other recent studies found that increases in the intensity of self-reported emotions were associated with greater positive coupling between regions such as the amygdala and dMPFC [35] and insula and vmPFC [36].

At first blush, these findings might seem inconsistent with other evidence that labeling emotions can be associated with decreased amygdala activity (for a meta-analysis see [13••]) and inverse correlations between other prefrontal regions associated with semantics (vlPFC) and the amygdala [37]. These inconsistent findings may occur because using concepts to make meaning of affect may have different effects across different instances. In some instances, labeling may heighten emotions by separating figure (the specific emotional experience) from ground (the affective and sensory components of the on-going experience), essentially transforming a general feeling of displeasure into a full-blown subjective experience of, say 'fear.' In other instances, using concepts to make meaning of affect may help to identify, and thus subsequently down-regulate emotions. The seemingly incompatible neuroimaging evidence mirrors the behavioral evidence, where sometimes manipulating participants' access to emotion concepts creates the experience of emotions (e.g. increased access to the word 'fear' makes people more likely to experience displeasure as threat; [25]), whereas at other times manipulating participants' access to emotion concepts reduces the intensity of self-reported [38] and peripheral physiological correlates of emotion [39,40]. Together, these findings may point to the importance of both context and participants' goals as a major determinant for whether language helps create and intensify or regulate emotions.

Manipulating language alters emotion: experimental evidence

Of course, a major limitation of neuroimaging evidence is that it is correlational. Yet experimental behavioral findings extend this evidence to demonstrate that facilitating or impairing access to linguistic emotion concepts alters emotion perception (for reviews see [11••,12••,27]) and even emotion experience (for a review see [12••]).

For instance, in a recent study [41•], we found that the presence of words in an emotion perception task sped and sensitized participants' perception of facial expressions. Specifically, across two studies, participants were quicker and more sensitive to say that emotion words (e.g. 'anger') matched an emotional face (e.g. a scowling face) than they were to say that one scowling face matched another. In principle, mere perceptual matching between faces should be an easier task to perform. Instead, emotion

words may have facilitated perception because they help participants engage in categorical perception, averaging over the many perceptual features that appear on a face to make a categorical judgment about the emotion being expressed (for a discussion see [42,43]).

These findings also converge with developmental research demonstrating that children's learning and use of emotion words in spoken language coincides with their ability to engage in more adult-like categorical perception of emotional facial expressions (for a review see [44]). These findings are correlational, but there is at least preliminary experimental evidence that children can use a process of elimination to associate a novel word with a novel, never-before-seen category of facial expression and then later differentiate this expression from others [45].

Finally, these behavioral findings converge with other work showing that temporarily impairing participants' access to emotion words slows them and makes them less accurate to say that two emotional faces match [46–48]. These findings are consistent with causal evidence showing that damage to brain regions that support language permanently impairs emotion.

Impairments to brain regions supporting language alter emotion: lesion evidence in adults

Lesion evidence in adults is perhaps the least plentiful, but most causal, evidence that language is an important 'ingredient' in emotion. In a recent study [26], we demonstrated that patients with semantic dementia, who have lesions to their ATL and deficits in naming and semantic memory following a neurodegenerative disease, become unable to perceive emotions in facial expressions. Patients were asked to sort pictures of posed emotional facial expressions (scowling, frowning, wrinkle-nosed, wide-eyed, smiling and neutral faces) into as many categories as they could identify. Unlike age-matched controls, whose piles of facial expressions roughly approximated the six English emotion categories in the set of faces (anger, sadness, disgust, fear, happiness and neutral), semantic dementia patients free-sorted facial expressions into roughly three categories corresponding to pleasure, displeasure, and neutral feelings. That is, without access to the meaning of emotion words, patients no longer saw faces categorically as anger, disgust, fear, etc.

Other evidence for a link between impairments in brain regions associated with language and impairments in emotion perception comes from neuroimaging studies of patients with frontotemporal dementia (FTD). Semantic dementia is a sub-class of FTD; FTD involves even more extensive frontal and temporal neurodegeneration, making it a useful case study for data-driven explorations of which frontal and temporal atrophy correlates with emotion perception deficits. Recent evidence [49•] found that FTD patients who have difficulty identifying discrete emotions in faces were especially likely to have degeneration in regions of the brain associated with semantics such as the vlPFC and ATL. FTD patients also show reduced chronic functional connectivity between these brain regions when compared to controls, suggesting that these brain regions less characteristically work together to implement psychological functions.

Looking toward more causal and mechanistic evidence

Although evidence for the hypothesis that language is a critical ingredient of emotion is growing (for recent reviews see [11••,12••,13••,27,44]), many findings remain circumstantial and the field still lacks clear causal evidence to this effect. The idea that language interacts with cognition has oft been a topic of debate [50] and the interplay between language and emotion has been the subject of psychological study for only about a decade (although see [51,52]). Thus, what is required moving forward is more causal evidence across diverse outcomes (i.e. brain activity, behavior, physiology, self-report) showing that the presence or absence of emotion words alters on-going perceptions and experiences of emotions. Causal evidence could come in a variety of forms. For instance, there is some evidence that the presence of words in tasks actively changes brain activity (for a review see [53••]), but more direct evidence that the presence or absence of emotion words actually changes the complex multivariate pattern of neural representation for emotions would be necessary.

Other causal evidence would stem from showing that pairing emotional sensations (whether visual representations of facial expressions or internal representations of subjective experiences) with words induces perceptions or experiences that did not exist before. The evidence in children at present is mostly correlational [44], but learning paradigms could be employed in both children and adults to demonstrate that words help induce categorical perception for emotion in ways that learning in the absence of words does not.

Finally, there is a need for more causal evidence that disrupting language disrupts emotions. Naturally occurring cases are available in clinical contexts (e.g. patients with semantic dementia) but these cases are hard to come by and are always open to alternate interpretations (e.g. it is hard to know the extent to which deficits are truly focal and exclusively limited to one domain). Thus, growing research using transcranial magnetic stimulation to temporarily activate or deactivate brain regions associated with language and testing the outcomes for emotion might be a promising avenue of future research.

Implications of a language-emotion link

These future directions notwithstanding, the existing research is sufficient to claim that language and emotion have more than a mere unidirectional relationship; the implications for this relationship are potentially sweeping. First, these findings suggest that prelinguistic infants', young children's, and non-human animals' emotions are likely quite different from adult humans' emotions, a fact which has a host of educational and policy implications. In the arena of education, there is indeed evidence that children who are explicitly taught about emotion concepts in school fare better on a range of social, emotional, and educational outcomes [54,55]. Second, these findings suggest that disorders that impair language (e.g. autism, aphasia) might have implications for emotion and social processing that are more far-reaching than typically assumed. Third, these findings suggest that people would do well to hone their emotion language; doing so might not only help them experience their emotions as more discrete and specific, but might also help to regulate them (see [56]). Finally, these findings suggest that emotions might in fact get lost in translation between cultures whose languages encode different emotion terms. Consistent with this idea, recent studies underscore the relativity in emotion perception across cultures [57–60], a finding that should be of concern in our increasingly global world. I look forward to future research weighing in on these basic and applied questions.

Conflict of interest statement

Nothing declared.

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