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The process of affect labeling

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Affect labeling can shape how emotions are experienced and shared, with important consequences for both well-being and relationships. While decades of research have explored the impact of articulating emotions through language, the labeling process itself has received limited attention until recently. We suggest that affect labeling can be considered analogous to perceptual decision making, as both involve accumulating evidence toward a decision. Building on perceptual theories of emotion, we explore how this perspective provides new insights into the mechanisms underlying affect labeling. We then review existing research applying sequential sampling models to affect labeling, illustrating how it accounts for the different processes involved in labeling and may explain mechanisms underlying individual differences in the labeling process.

Affect labeling as perceptual decisions

Affect labeling is defined as a process by which individuals articulate their emotions through language [1]. People label their emotions in different situations: when they realize how they feel in response to an emotional state, such as a sad movie or a scary alley; when they describe their feelings in response to a recent situation to a close friend or a therapist; or when they send an emoji to a group text or a social media feed. Emotion labels are ubiquitous and crucial to the way people communicate and understand their emotional world.

Much of the research on labeling has focused on the contribution of labeling emotions to one's emotional experiences and well-being. Some studies provide evidence that affect labeling is related to positive outcomes, including changing the intensity of emotional experiences [2,3], influencing the duration of these experiences [4], and improving well-being and social connections [4–7]. Labeling is therefore perceived as an important regulatory instrument in the way emotions are experienced and processed [8]. However, other research shows that labeling can sometimes impede emotion regulation strategies [9], increase emotional intensity in potentially maladaptive ways [3], and that individuals who use more diverse negative emotion words may experience greater distress and depression symptoms [10,11]. Whether positive or negative, most research on affect labeling has focused on the outcomes of labeling and its relations to other constructs.

But how do people actually label their emotions? In this Review, we suggest that affect labeling can be conceived as analogous to a perceptual decision. From this perspective, just like perceptual decisions, labeling emotions involves integrating signals from the mind, body, and environment until the evidence reaches a decision threshold, in which labeling occurs. This approach is deeply rooted in William James's perceptual theory of emotions [12], which described the process of emotion as inherently a process of perception. Just as our senses detect and interpret external stimuli (e.g., hearing sounds or tasting food), our emotional system detects and interprets internal and external events, leading to the labeling of emotions. James's idea of emotion-as-perception provides a good starting point for understanding how people make sense of their emotional experiences through labeling (see Box 1 for the historical roots of affect labeling as perceptual decisions).

Highlights

Affect labeling, or 'putting feelings into words', influences both individual experience and social connection, shaping emotional intensity, duration, and regulation of emotions. However, the process by which people assign an emotion label to their experience remains unclear.

We introduce an approach that conceptualizes affect labeling as a perceptual decision, involving a process of evidence accumulation toward a decision threshold. Accordingly, labeling emerges from integrating emotional evidence from multiple sources, including body sensations, cognitive appraisals, and action tendencies. Sequential sampling models provide the quantitative tools to test this framework.

This work bridges two flourishing lines of research: the growing interest in understanding how emotional experiences are labeled with the methodological advancements of decision-models developed in cognitive science.

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One central idea that emerges from the notion of emotion-as-perception is that, similar to perceptual processes, emotional processes involve accumulating evidence to reach an emotional decision, an act of affect labeling. Imagine two people looking up at the sky, trying to figure out what the object flying overhead is. One of them observes the object for a few seconds, gathering evidence by noting its shape and movement. Once the evidence reaches a certain threshold, she turns to her companion and makes a perceptual decision – 'It's a plane'. Similarly, consider a person who hears from a colleague that they could improve their performance on a shared project. In this situation, they gather evidence from the external stimulus (the colleague's comment) and from their own mind and body – their appraisals, physiology, action tendencies, etc. (all components of emotion [13]). Once this emotional evidence reaches a labeling threshold, affect labelling takes place, and the person can tell their colleague – 'I feel angry'. In the following sections, we highlight both the theoretical and empirical aspects of affect labeling as perceptual decisions.

What is affect labeling?

The idea of 'putting feelings into words' could mean different things in various contexts and is operationalized and measured differently in empirical studies. This section outlines how affect labeling has been defined in the literature, differentiates it from similar constructs, and clarifies important differences between labeling in the lab and in the field. While definitions of affect labeling vary, in this Review, we define affect labeling as the process of translating emotional experiences into verbal expressions. This includes not only explicit emotional words but any phrase that conveys emotional meaning, whether through direct valence descriptions, context-dependent statements, or culturally mediated expressions. Our definition takes an ontological perspective, that is, what labeling is, rather than an epistemological one, that is, what is considered labeling by a perceiver.

Some expressions should clearly be categorized as labeling. Expressions such as 'I'm happy', 'I'm so angry', or 'This is frightening for me' contain a clear emotional label. Direct descriptions of valence are also acts of affect labeling. When someone is saying 'This is unpleasant' or 'It feels good', they are putting their feelings into words and providing a label to an affective experience. Note that there can be an overlap between labeling valence (negative or positive) and labeling specific emotions. Sometimes, saying 'I feel bad' in a certain context can be used as shorthand for describing a more specific emotional state, such as guilt; in other cases, it may represent multiple negative emotions. When the label itself is an explicit emotion word or valence description, it is relatively easy to identify it as affect labeling.

Some forms of emotion expression in which a specific label is not mentioned become labeling based on the context in which they are expressed. For example, the mere reporting of physiological changes: 'My hands are sweating' or 'My heart is beating', could mean that someone is excited or anxious if they are facing a stressful event. However, in a different situation, it could mean that they have just completed a high-intensity cardio training. These context-dependent cases are harder to classify as labeling and thus are more challenging to measure. Even expressions that are not inherently emotional can still convey someone's emotional state. For example, phrases such as 'Holy cow!', 'This made my day', or 'For crying out loud!' may sometimes function as affect labels (e.g., surprise, joy, or frustration), but they do not have a strict one-to-one mapping with specific emotions and can also serve other expressive functions. Whether they count as affect labeling may depend on parameters such as the intentionality of the speaker and the mutual understanding between speaker and perceiver. Such expressions highlight that the function of affect labeling is not tied to the literal wording, but to how words are used to capture and communicate an emotional experience. For instance, saying 'you drive me crazy' usually conveys anger or annoyance rather than insanity, and may carry an essence that words like angry

or annoyed alone cannot capture. Context, language, and culture play an important role in determining whether an expression is labeling or not.

In addition to describing what is captured by our definition of affect labeling, it is also important to describe what is beyond the scope of the definition. The first is unconscious processes of labeling. Affect labeling processes can be classified based on the level of awareness of the person experiencing the emotions, defined by Gyurak as explicit versus implicit labeling [14]. Explicit affect labeling involves conscious, deliberate articulation of emotional states, when individuals intentionally name or describe their feelings [15]. This explicit form of labeling differs from the implicit semantic categorization processes that may occur automatically during emotional experiences without conscious awareness [5,16]. Neuroimaging studies suggest these processes recruit partially distinct neural circuitry [1,2]. Given that we do not have access to unconscious labeling processes, we consider these processes beyond the scope of the current paper. At the same time, we believe that explicit and implicit labeling likely share common underlying mechanisms, and we hope that future research will test this idea directly.

A second process that is beyond the scope of this Review is emotional granularity, defined as the ability to precisely identify and differentiate between emotional experiences [17]. Importantly, granularity is not reducible to the use of emption labels, but rather refers to the richness of the experiences themselves, with language serving as one means to capture this differentiation [18]. Just like labeling, high emotional granularity seems to be related to a variety of positive outcomes, including more effective emotion regulation, reduced anxiety and depression symptoms, and more adaptive behavioral responses to situational demands [18,19]. While the two constructs are clearly similar, they are also different. Labeling is the more basic form of putting emotions into words, whereas granularity concerns the quality and specificity of how one's emotional experiences are differentiated. This paper examines the fundamental process of translating feelings into language rather than the individual differences in how precisely or specifically people do it.

Beyond outlining the definition and scope of affect labeling used in this Review, it is also worth noting that the ways labeling is examined in the laboratory and expressed in the field are often inherently different. In empirical studies, affect labeling has traditionally been operationalized as a task of selecting from predetermined emotion labels (e.g., choosing 'anxious' vs 'excited' from a fixed set of options, or rating the extent to which one feels each emotion from a provided list). However, this is not necessarily how people generate labels in ecological settings [20,21]. Both affect labeling and perceptual decisions are complex processes influenced by motivational, contextual, and social factors. In fact, even basic perceptual categorization involves motivational influences that shape the integration of evidence [22–24]. Yet, in both domains, researchers often use simplified laboratory paradigms to understand the underlying mechanisms. Consider the difference between spontaneously reflecting on one's emotional experience versus responding when a therapist directly asks whether one was feeling more anger or sadness. Despite the apparent differences, we suggest that these two forms of labeling may be driven by a similar underlying process, though with varying constraints on expression: from the limited vocabulary of a forced-choice question to the open-ended, personally driven descriptions of emotional experiences. Going back to our affect labeling–perceptual decision analogy, a perceptual decision of whether something is a bird or a plane can also happen both spontaneously and in response to a request. Just like labeling, perception is also mostly studied with a list of predetermined perceptual categories, with the assumption that the underlying process for both spontaneous and predetermined is the same. However, opportunities remain to extend this research into more ecologically valid spontaneous affect labeling measures, as elaborated in the following sections.

Evaluating the process of labeling in empirical studies

The process of evidence accumulation operates on the premise that decision-making results from sequentially sampling evidence in a noisy environment until a decision threshold is reached. Drawing inspiration from research on perception [25–27] and decision making [28–30], in the past few years, it has been suggested to adopt sequential sampling models (SSMs) [31–35] as a way to assess evidence accumulation in affective science [36–40] (see Box 2 for how SSM parameters can map onto the labeling process). Sequential sampling models are based on separating underlying mechanisms of decision making by interpreting variance related to error rates and reaction times (see Box 3 for details on how to produce accuracy rates in emotional tasks). As suggested by Roberts and Hutcherson [41], when the framework of integrating SSMs into affective science is well defined and parameters are mapped to concepts, it can reduce conceptual ambiguity and uncover theoretical assumptions and predictions.

Previous applications of SSMs in emotion research

So far, the primary use of SSMs in understanding emotions has been in explaining decisions in emotional situations, rather than affective labeling *per se*. These studies have taken two distinct yet complementary approaches to examining how emotions influence decision-making: one line of research has focused on how momentary emotional states affect choices, looking, for example, to study how mood affects media selection preferences [42] and how emotional valence influences subsequent semantic judgments [43]. A complementary line of research has examined how trait-level emotional tendencies shape decision-making, applying SSMs to account for individual differences in emotional processing. Studies showed, for example, that depressive symptoms in adolescents were associated with impaired process of evidence accumulation of facial expressions [44] and with an efficient accumulation of evidence towards negative self-

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Box 1. Historical roots of affect labeling as perceptual decisions

The first to propose the idea of emotion-as-perception was William James, who stated that 'Emotional-brain-processes not only resemble the ordinary sensorial brain-processes, but in very truth are nothing but such processes variously combined' [12]. James emphasized physiological changes as the raw material of emotion and asserted that, contrary to the natural way of thinking, our detection of bodily disturbances is, in fact, the emotion. James' argument is often criticized for its simplicity. However, it is suggested that James' theory has been mischaracterized and oversimplified [73]. Some scholars claim that James acknowledged other components beyond physiology and specifically included cognitive interpretation – what he termed 'the perception of the exciting fact' [74].

Schachter and Singer's two-factor theory [75] built upon James' foundation but made the definition of cognitive interpretation more explicit. They argued that emotions occur as a result of the integration of two components: physiological arousal and cognitive appraisals, which consist of evaluations of the current context in which the emotion is experienced. Schachter and Singer's theory can be seen as a foundation for later appraisal theories of emotion [76,77]. Like James, they concentrated on the emotion itself, viewing labeling as a potential byproduct of the emotional experience.

Schacter and Singer's theory puts the construction of appraisals and physiological signals at the center of the emotional process. A more recent perspective, set forth by Barrett [78], takes this idea further, arguing that emotion language plays a central role in making an affective reaction an emotion. The theory of constructed emotion views emotions as an ongoing process of meaning making out of basic ingredients, such as physiological sensations and past experiences, which are not unique to emotions but form the basis for all mental states. Core affect is interpreted within a specific context and can thus be constructed as different emotions depending on the situation. The concept of construction entails that the emotional process itself is an act of making meaning, which often involves providing a label to an affective state [79]. In constructionist theories, labeling does not necessarily mean explicit affect labeling, but refers more broadly to the role of emotion words in constructing emotion, whether expressed to another person or processed in internal monologue.

The affective lineage of emotion as perception that stretches all the way from William James to Barrett sees labeling as a meaning-making process designed to interpret a set of signals. Viewing affect labeling as perceptual decisions seems to be congruent with perceptual theories of emotions. From a labeling perspective, we do not see labeling as a necessary step in the emotional process, as we perceive this approach to limit the scope of what is considered an emotional response to only labeled responses. Although we recognize that emotional responses extend well beyond what can be captured through labeling alone, our focus here is on understanding the labeling process itself.

descriptive words [45]. In addition to depression, recent research has shown that anxiety and stress were associated with less efficient emotional processing and regulation [46]. Collectively, these studies illustrate how SSMs offer a structured approach to uncovering latent mechanisms underlying emotion-related decisions, allowing researchers to move beyond self-reports and gain a process-level understanding of the interplay between emotion and cognition.

Applying SSMs to affect labeling

While initial research has primarily focused on how affect influences decision-making, only recently have researchers begun to utilize SSMs and emphasize affect labeling as the outcome variable, the decision being measured [47]. This framework conceptualizes affective self-reports as arising from the weighted integration of multiple sources (including interoceptive, proprioceptive, and appraisal information) that accumulate over time toward response thresholds. Recent developments in implementing SSMs in affective research open opportunities to explore latent processes that occur between exposure to a stimulus and the labeling decision (see Box 2 for elaboration). In order to support the notion of affect labeling as perceptual decisions, research should provide empirical evidence demonstrating that affect labeling operates in a manner consistent with perceptual decisions.

Affect labeling operates as a perceptual decision

One way to examine the proposed analogy between affect labeling and perceptual decisions is by testing whether labeling follows fundamental principles of perception. An example of such a

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Box 2. Mapping SSM parameters to the labeling process

Parameters of SSMs provide insights into various aspects of the labeling process. The Threshold parameter accounts for the quantity of emotional evidence required for labeling. Essentially, it reflects participants' policy regarding the tradeoff between speed and accuracy. Individuals who are more cautious in reporting their emotional experiences require a larger amount of emotional evidence and consequently take longer to decide on their emotion label. The height of the Threshold can be adjusted according to different contexts and experimental designs (e.g., when implementing a speed–accuracy manipulation [80]). The Drift-Rate parameter represents the average rate of accumulation of emotional evidence. It is shaped by the emotional intensity of the stimulus, the changes in the emotion system upon exposure to the stimulus, and the individual's ability to detect these changes. Additionally, individuals with richer emotional vocabularies and greater conceptual knowledge about emotions may show more efficient evidence accumulation, as they can more readily access relevant emotional concepts to guide the interpretation of their experiences [81,82].

The Starting Point parameter reflects systematic tendencies in affect labeling. A bias toward anger places the starting point nearer the 'anger' boundary, requiring less evidence for that label. Such bias can reflect personality traits, prior experience, or cultural influences. Cultural differences in emotion concept accessibility could systematically shift starting points toward culturally emphasized emotions [70]. The SV parameter, which reflects the between-trial variability in drift rate, captures how consistent an individual's evidence accumulation process is across different emotional episodes. A person with high variability indicates that their ability to accumulate emotional evidence fluctuates – sometimes processing emotional cues efficiently and clearly, other times struggling to integrate emotional information effectively. This parameter may relate to individual differences in emotional clarity, or how situational factors (stress, fatigue, or attention) affect emotional processing. Finally, Non-Decision Time captures processes unrelated to the decision itself.

While current research integrating SSMs with affect labeling has primarily focused on binary decisions (e.g., pleasant vs unpleasant), people naturally choose from many emotion words when labeling their feelings. SSMs have already been successfully applied to multiple-choice decisions using models such as the Linear Ballistic Accumulator (LBA) [32], its multi-attribute variant [83], and Racing Diffusion Models [84] (see Figure 1B in main text). Building on these advances, the next step would be to examine spontaneous emotion label generation, where people generate their own labels without predetermined options. Work in perceptual research, which uses SSMs to model basic decision processes such as whether to respond to a stimulus [85], could provide the methodological basis for developing such implementations. For example, researchers could design tasks where participants first indicate when they have reached an emotional decision (measuring reaction time to this point), and then articulate whatever emotion word best describes their experience. The spontaneously generated emotion words could then be mapped onto predetermined criteria – such as valence categories, arousal levels, or specific emotion families – allowing researchers to apply SSM analyses while preserving the ecological validity of spontaneous label generation.

Box 3. Challenge of defining ground truth in affect labeling

The challenge in using sequential sampling models for describing affect labeling lies in defining the ground truth against which subjects' responses are compared. Emotional experiences are perceived as inherently subjective, lacking a definitive truth value. Unlike perceptual tasks, where there is often a clear correct answer, emotional experiences do not have such straightforward 'right' or 'wrong' responses.

Determining what is a 'correct response' is not entirely foreign to emotion theories. Basic emotion theories, which posit universal emotional categories, imply that there are prototypical ways of experiencing and expressing emotions. From a constructionist view, cultural norms shape emotional experiences and expressions, suggesting that emotions can be judged as more or less 'correct' based on normative expectations. Despite these theoretical considerations, translating the concept of emotional correctness into measurable constructs for empirical studies remains challenging.

We posit that social norms can serve as a reasonable proxy for a 'true label' in emotional contexts. This approach stems from the common practice in everyday life of relying on others' average ratings to evaluate expected experiences (i.e., when choosing a hotel). We empirically addressed this issue by testing whether error-related effects can be detected in 'errors' in labeling tasks in the form of deviations from social norms [80]. Results showed similar patterns between perceptual errors and 'emotional deviations' from norms, suggesting that the experience of labeling counter-normative emotion is similar to making a perceptual error. Complementing this approach, recent work on affective abstraction demonstrates that the extent to which individuals' affective judgments deviate from population norms is itself informative, predicting traits such as alexithymia, depression, and autism spectrum characteristics [86]. The use of social norms as a benchmark for emotional 'correctness' allows us to apply established methods from research on perception to the study of emotions. By defining emotional errors, we can use data on reaction times and accuracy rates to generate parameters for SSMs in labeling tasks. However, it is important to acknowledge the limitations of this approach. Social norms can vary across cultures and contexts. Recent advances in metacognition define emotional correctness by assessing individuals' ability to monitor their own emotional judgments. Research demonstrates that people exhibit measurable sensitivity in evaluating their emotional experiences [87] and predictive processing mechanisms [88]. This suggests 'errors' in affect labeling arise as discrepancies between felt confidence and actual labeling accuracy.

principle is Weber's law, a cornerstone of human perception that describes the relationship between the actual change in a physical stimulus and its perceived change [48–50]. According to Weber's law, the smallest perceived change (just noticeable difference; JND) is proportional to the intensity of the original stimulus, such that larger stimuli require more significant changes to

Box 4. Clinical outcomes of affect labeling

Exploring the process of affect labeling offers valuable applications for psychological wellbeing. This perspective extends beyond conceptualizing labeling as implicit emotion regulation [5], claiming that the end result of assigning an emotion label improves mental health [7,15]. Instead, we suggest that looking at the labeling process itself and exploring the underlying mechanisms of it holds vast potential to foster more tailored interventions, tackling the specific deficits in the emotional process. Viewing affect labeling as a complex, multifaceted process provides a path for explaining inconsistent findings [9] and enhancing clinical understanding.

These process-focused insights are particularly valuable when considering conditions characterized by emotion labeling deficits. A promising development is the distinction between affective agnosia (difficulties in categorizing/recognizing emotional experiences) and alexithymia (difficulties in articulating/describing emotions) [16]. An evidence accumulation framework can help differentiate these conditions within the affect labeling process: affective agnosia may reflect difficulties in efficiently gathering and integrating emotional evidence from various sources (reflected in the Drift-Rate parameter), while alexithymia may reflect a systematic bias towards nonemotional words, reflected in parameters such as the starting point or threshold. This pattern would be consistent with the tendency of individuals high in alexithymia to rely less on emotion and affect labels and more on bodily or situational descriptions. Adopting this nuanced approach facilitates understanding of the labeling process, highlighting what is necessary for successful labeling by examining what happens when it goes wrong.

Expanding on this perspective, research dissecting the different types of evidence accumulated towards labeling can significantly improve therapeutic interventions. Recent work [89] demonstrated the critical importance of identifying the source of emotions (source attribution) to the manifestation of clinical contexts. Specifically, individuals experiencing suicidal ideation showed specific deficits in identifying the origins of their emotional experiences. From an evidence accumulation approach, source attribution is part of the emotional evidence accumulated, similar to other appraisals such as personal relevance. As such, it is likely that deficits in the ability to identify the origins of emotional experiences influence the efficiency of evidence accumulation. More broadly, by treating affect labeling as a multifaceted process, clinicians can develop more nuanced and effective therapeutic strategies that address the specific aspects of affect labeling most relevant to different clinical presentations.

be perceived as different [51]. Translating Weber's law to affect labeling suggests that detecting an emotional difference between two highly intense stimuli requires more differentiation along the emotional intensity scale compared to low intensity stimuli, where detecting even a small difference becomes easier.

Two recent studies [52,53] examined the Weber Law in affective labeling. In these studies, participants saw emotionally evocative images, ranging from highly negative to highly positive, and were asked to make binary pleasant/unpleasant judgments while measuring both their choices and response times. The researchers then fitted SSMs to these data and analyzed the Drift-Rate parameter, which reflects the mean rate of evidence accumulation across trials (see Box 2 for details). More specifically, they analyzed the variance of the Drift-Rate to quantify decision uncertainty, as higher variance indicates less consistent evidence accumulation across trials. Their findings revealed that the variance of the Drift-Rate increased systematically with emotional intensity for both pleasant and unpleasant emotions, exactly as Weber's law would predict. This pattern indicates that distinguishing between two highly intense emotional stimuli (whether positive or negative) requires greater differences in emotional intensity compared to distinguishing between mildly intense stimuli, where smaller differences become more easily detectable. Demonstrating that affect labeling adheres to Weber's law significantly strengthens the analogy between affect labeling and perceptual decisions.

A second support to the idea that affect labeling follows similar computational principles as perceptual decisions comes from comparing model fit between affect labeling tasks (making binary pleasant/unpleasant judgments to emotionally evocative images) and standard perceptual decision tasks (deciding whether a presented face was male or female). Using SSMs, researchers found remarkably similar patterns across both types of decisions – affect labeling and perceptual. Despite involving completely different stimuli, response mappings, and instructions, the emotional and perceptual tasks were characterized by nearly identical computational processes. The quality of model fits was equivalent across both domains, suggesting that the same evidence accumulation mechanism underlies both affect labeling and perceptual decisions [54,55].

To validate that the model truly captures the underlying processes it is designed to, the researchers also demonstrated selective influence [30]. Selective influence is the idea that a specific manipulation within the experimental design influences only a particular parameter of the model while leaving other model parameters unchanged. For example, manipulations that affect the quality or strength of sensory evidence (such as intensity manipulation) should selectively influence only the Drift-Rate parameter, which reflects evidence accumulation, while leaving decision thresholds unchanged. Testing this principle in affect labeling, two experiments [54] presented participants with emotionally evocative images and asked them to make binary pleasant/unpleasant judgments. Emotional intensity was manipulated by using stimuli that had different levels of emotional intensity, both negative and positive, and the researchers examined which SSM parameters were affected. Consistent with selective influence, emotional intensity specifically modulated evidence accumulation processes: the Drift-Rate was higher for higher-intensity stimuli compared to lower-intensity stimuli, while decision thresholds remained unaffected.

Sources of emotional evidence

The preceding discussion has established important aspects supporting the analogy between affect labeling and perceptual decisions. Building on this groundwork, subsequent research sought to answer the question: How do different components of emotion impact the labeling process? Based on Scherer's component model of emotion [13] (Figure 1A), we suggest that the emotional evidence accumulated toward labeling is composed of cognitive appraisals, physiological responses, action tendencies, and expressive behavior [54,55]. This internal evidence
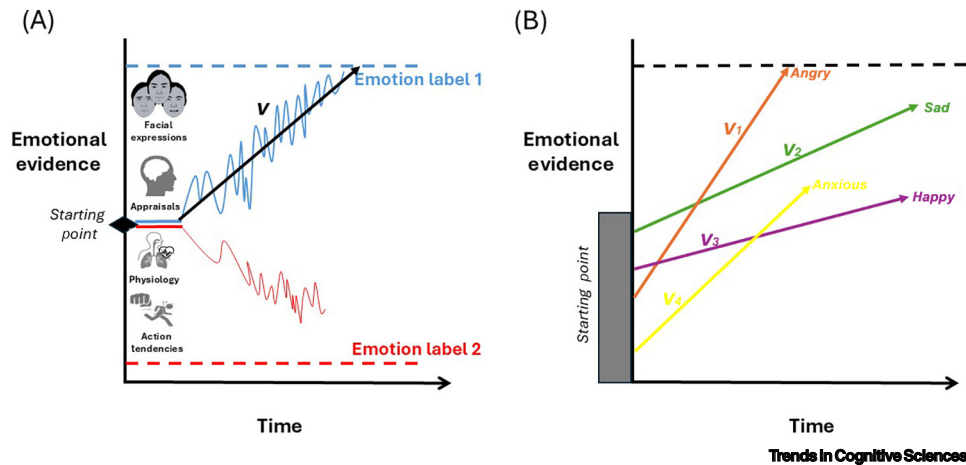
Figure 1. Illustration of affect labeling as a process of accumulating emotional evidence. The x axis represents time and the y axis represents emotional evidence. Sources of information are represented by the icons: facial expressions, appraisals, body sensations, and action tendencies. The threshold (dashed lines) reflects the amount of evidence required for labeling. (A) Shows a competition model (i.e., DDM) where evidence accumulates toward two competing emotion labels, with evidence for one label working against the other. The first accumulator to cross its threshold determines the selected emotion label – 1 or 2. (B) Illustrates a racing model (i.e., Linear Ballistic Accumulator) where evidence from the same sources simultaneously feeds multiple independent accumulators racing toward a common threshold. In this example, ANGRY shows the highest drift rate (V , steepest slope) and wins the race, while HAPPY shows an initial starting point advantage but slower accumulation rate (V), demonstrating how both the initial bias and the quality of the emotional processing influence the labeling outcome.

accumulation process is influenced by external factors such as cultural norms, available emotion vocabulary, and social context. There seems to be a wide consensus regarding the componential structure of emotions, as described in multicomponent theories [56]. However, the literature calls for further empirical validation, particularly in differentiating these components and exploring their unique contributions to labeling.

Recent work began to answer this question by specifically examining how modifying cognitive appraisals influences emotional evidence accumulation [57,58]. In two experiments, participants watched emotionally evocative images and were asked to label their emotions as either pleasant or unpleasant [57]. Appraisals were manipulated by describing the pictures as either real or fictional [59]. This description shift was expected to modify the appraisals generated while viewing the stimuli, specifically affecting participants' assessment of the personal relevance and reality of the depicted events. From the perspective of accumulating emotional evidence, researchers expected that altering appraisals from real to fictional should slow only the rate of evidence accumulation but not other variables. Results showed that when stimuli were described as fictional, the rate of evidence accumulation was indeed lower, suggesting the manipulation affected the way participants processed the emotional evidence toward the emotion label [57]. This finding highlights the significant role that appraisals play in the labeling process and supports the view of cognitive appraisals as an essential component of emotion. Ultimately, these studies [57,58] could serve as catalysts for further research exploring the weight of each component comprising the emotional evidence involved in labeling, including manipulating bodily postures, facial expressions, and physiological arousal.

Individual differences in the process of labeling

Once some of the basic assumptions regarding labeling as evidence accumulation were validated, more advanced recent research sought to explore variations in affect labeling among different populations. This growing interest in individual differences reflects a broader recognition that affect labeling varies significantly across individuals and can be characterized by distinct

aspects of the labeling process [60]. In a recently published paper, researchers used sequential sampling models to examine whether gender differences influenced the evidence accumulation process leading to labeling [55]. Across nine different studies (all using a version of the labeling task described in the preceding text), women showed a higher rate of evidence accumulation towards negative labels compared to men. Importantly, these differences in evidence accumulation were not observed when looking at the mere tendency to report negative emotions. Namely, women were not simply more emotional, nor did they require less evidence to label negative emotions; rather, they generated their negative labels more efficiently than men. Using models that evaluated the process of evidence accumulation in labeling allowed researchers to bypass the challenges of raw self-reports, which are particularly concerning in studies of gender differences in emotions (i.e., the influence of gender stereotypes on emotion reports) [61]. This research regarding gender differences illustrates the vast potential for examining other individual differences, including personality traits, mental conditions (Box 4), and cultural characteristics. These insights set the stage for future explorations into how various factors influence labeling, guiding new research directions.

The research reviewed in the preceding text provides substantial support for conceptualizing affect labeling as a perceptual decision-making process. Studies have demonstrated that affect labeling follows fundamental perceptual principles, allowing for systematic examination of the sources of emotional evidence and the aspects of labeling that vary across individuals. These findings collectively establish that SSMs can effectively decompose the complex process of affect labeling into interpretable parameters, offering a powerful tool for understanding how people transform subjective emotional experiences into explicit reports.

This computational approach enables researchers to quantify the underlying mechanisms of affect labeling in ways that were previously inaccessible. These models hold significant promise for expanding research beyond binary valence toward multiple specific categories of emotion, as well as the spontaneous generation of emotion labels in naturalistic settings (Figure 1 and Box 2). In addition, integrating SSMs with ecological momentary assessment (EMA) can examine labeling as it unfolds in daily life, offering greater ecological validity than laboratory tasks. Recent advances demonstrate the feasibility and value of applying computational models to EMA data [62]. Taken together, recent developments preserve the computational advantages of the evidence-accumulation framework while capturing naturalistic variability in labeling, displaying the broad potential of SSMs to address key questions about emotional experience and its translation into language.

Future directions: individual, interpersonal, and cultural perspectives

Advancing research on affect labeling calls for attention across multiple domains (see Outstanding questions for key directions and open issues). Three levels for studying labeling – individual, interpersonal, and cultural – can be extended and integrated with current research in affective science. Adopting the idea of emotional evidence accumulation offers promising avenues for understanding how personal characteristics shape affect labeling processes. Developmental research shows that emotion representations shift from valence-focused to bidimensional across age [63], while emotional granularity follows a nonlinear trajectory, high in childhood, low in adolescence, and high again in adulthood [64]. An evidence accumulation approach could reveal the computational mechanisms underlying these patterns: what is it about adolescence that impairs the successful accumulation of emotional evidence? Perhaps ongoing neurobiological development reduces adolescents' ability to efficiently integrate evidence from multiple emotional sources, or social demands during this period create pressure to respond quickly at the expense of gathering sufficient emotional evidence before making labeling decisions. Similarly, research shows that stress reduces emotional differentiation, with higher stress levels predicting lower

emotion differentiation the following day [65]. From an evidence accumulation perspective, this could reflect multiple mechanisms: stress might introduce noise that disrupts efficient evidence processing of positive emotions, but it could also create systematic biases toward negative emotion labels. Indeed, ecological momentary assessment studies consistently demonstrate that higher stress levels are associated with increased negative affect in daily life [66]. This suggests that stress may systematically shift various factors in the labeling process, specifically when comparing positive and negative emotions.

The current conceptualization also extends to interpersonal processes, where affect labeling abilities shape social interactions and emotional understanding. Cognitive empathy, recognizing and understanding another person's emotional experiences [67], could be viewed as accurately labeling the emotions of others. Accordingly, we suggest that when people label others' emotions, they integrate emotional evidence from multiple sources: their own emotional experiences (bodily sensations and appraisals), their social partner's facial expressions and behavior, and semantic knowledge about normative emotional responses. An evidence accumulation approach could illuminate how people weigh these different sources of evidence when making judgments about others' emotions, and how individual differences in affect labeling abilities influence empathic accuracy. This conceptualization can contribute to the study of empathy and its facets, specifically by understanding which facets to engage and when, to enhance social and emotional outcomes [68].

Beyond individual and interpersonal processes, the idea of affect labeling as perceptual decisions can provide insights into cultural differences in labeled emotional experiences, thereby addressing the broader question of whether emotions are universal or socially constructed [69]. This approach recognizes that the evidence accumulation process is fundamentally shaped by cultural norms [70], available emotion vocabulary [71], and social expectations about appropriate emotional expressions [72]. This line of research has the potential to overcome inherent challenges associated with raw self-report, which become even more pronounced when exploring different societies. For example, which aspects of the labeling process are shaped by culture? Which sources of information are more universal, and which are more dependent on context and society? Addressing these questions can lead to the development of more culturally sensitive measures of emotion and improve cross-cultural research on affect labeling.

Concluding remarks

We present a conceptualization of affect labeling as a perceptual decision, grounded in the perceptual theory of emotion and supported by growing empirical evidence. Framing affect labeling as analogous to perceptual decisions facilitates a more precise examination of its underlying mechanisms. Specifically, viewing labeling as a process of accumulating emotional evidence allows researchers to explore how different sources of emotional evidence, such as physiological responses, cognitive appraisals, and action tendencies, contribute to the labeling process. Coupled with strong computational tools like SSMs, this approach can shed light on how different individuals accumulate emotional evidence and decide on their emotional labels.

To conclude, this Review underscores the value of integrating affective science with research on perception. We look forward to more research that implements computational models to better understand how people label their emotions, and how insights into this common process can enhance human interaction, improve understanding of psychopathology, and inform therapeutic interventions.

Declaration of interests

No interests are declared.

Outstanding questions

What other processes in affective science could be described as analogous to perceptual decisions? Do they involve the process of evidence accumulation? Beyond affect labeling, this approach might reveal similar decision-making process in constructs such as empathy and emotion regulation.

What are the contributions of each emotional component to the labeling process? Can we measure the way they interact with each other?

Are there any other types of sources beyond the components of emotions that influence the labeling process? In what ways?

What are the potential implications of this approach for psychological well-being and mental health? Can we describe different symptoms as deficits in the labeling process? Can we use insights to create specific interventions? How might variations in evidence accumulation rate or decision thresholds relate to different psychological conditions?

How might collective emotional experiences challenge or extend our current understanding of individual affect labeling? Can the process of emotional meaning-making be understood as a social and interactive phenomenon that transcends individual cognitive and physiological boundaries?

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