Book Review

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L. F. Barrett, P. Niedenthal, & P. Winkielman (Eds.).
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420 pages

This compendium provides a timely and excellent summary of current theories and supporting data regarding the relationship between emotion and consciousness, focusing in particular on the issue of which components of affective processing can be unconscious. This distinction may not be the most critical one for synthetic emotions at this point. Nevertheless, the discussion of these issues by a number of prominent emotion researchers provides useful insights regarding the structure and processes mediating a broad range of affective phenomena (emotion generation, cognitive appraisal, emotion consequences, emotion-cognition interaction), as well as the roles of emotions in general. The theories and findings about affective processes in biological agents can serve as useful metaphors for modeling emotions in synthetic agents, and provide specific guidelines for model development.

Individual chapters in this edited volume address emotions from both psychological (cognitive, social, animal behaviorist) and neuroscience perspectives. The introduction provides a good integrative summary of the individual chapters, and introduces the three questions posed to all of the contributors, regarding definitions of ‘emotions’, ‘consciousness’, ‘awareness’, and the extent to which each theory presented addresses the issue of conscious vs. unconscious emotions. These questions help provide a more integrated treatment of the subject than is frequently seen in similar compendia.

In this review I provide a brief summary of the individual chapters, but focus primarily on three themes particularly relevant for modeling emotions in synthetic agents: embodied emotions, issues related to the reification of emotions, and an assessment of the book’s usefulness for computational modeling of emotion and consciousness. A more extensive review that addresses the theme of conscious and unconscious emotions can be found in Hudlicka (2009).

1. SUMMARY OF CHAPTERS

The book is divided into 5 sections, addressing conscious vs. unconscious processing across specific components of emotion: cognition and
emotion, unconscious emotional perception (that is, perception of affective stimuli such as affective facial expressions and body-posture), unconscious emotional behavior (e.g., facial expression, non-linguistic vocal signaling, and classical conditioning), the nature of the subjective experience of emotion, and broader perspectives on the conscious-unconscious debate.

The cognition-emotion section provides perspectives from social psychology (Niedenthal et al.), and from neuroscience and physiological psychology (Phelps and Gray chapters). Niedenthal et al. present the intriguing idea that experiencing and recognizing one’s own emotion, recognizing another’s emotion, and reasoning about emotion are all mediated by the same underlying processes, closely linked to the somato-sensory and motor representations associated with the embodied aspects of emotions; e.g., facial expressions, posture).

Phelps discusses recent research on the role of the amygdala in affective processing; specifically, its role in directing attention and perception to self-relevant stimuli, particularly those associated with a potential threat, but also its role in modulating the encoding and retention of emotional events. Phelps emphasizes the interdependent nature of affective and cognitive processing, brings into question the utility of distinguishing between emotion and cognition in the first place, emphasizing the fact that many neural circuits are shared by what has traditionally been categorized by ‘emotional’ and ‘cognitive’ processing.

Gray et al. suggest that the role of emotions is to help resolve control dilemmas in systems that are “sufficiently complex to experience them”. Like many emotion researchers (e.g., Damasio, Frijda, Oatley-Johnson), Gray suggests that emotion helps assign priorities to processing (e.g., selective attention) and behavior (selection of a behavioral alternative), and plays a critical role in goal management. Like Phelps, and most affective neuroscientists in general, Gray emphasizes the interrelated nature of cognition and emotion, and the role of each in resolving the control dilemma.

The three chapters in the section on unconscious emotional processing focus primarily on the visual processing of emotional facial expressions. Lundquist and Ohman discuss the specific facial muscles characterizing some of the basic emotions. They focus primarily on the survival-critical ability to rapidly differentiate between threatening and non-threatening faces, and the ability of the associated facial features to direct pre-attentive processing, allowing faster detection of potentially threatening faces. Gelder also discusses unconscious perception, focusing on the unconscious recognition of, and discrimination among, affective facial expressions, and provides detailed time-course data regarding the activation of different neural regions and pathways. Atkinson and Adolphs discuss the conscious and unconscious processes mediating perception of emotion from visual cues, primarily facial expressions, and emphasize the importance of dynamic stimuli, citing evidence for the existence of neural circuitry specialized for detecting facial and body motion cues. They cite evidence indicating distinct neural circuitry associated with the processing different emotions, and include a discussion on the perception of social emotions such as shame and pride. Like Gelder, they discuss the role of the emotion contagion mechanism in mediating emotion recognition via activation of the affective circuitry in the perceiver, in response to an observed affective expression, thereby lending further support to the theories discussed by Niedenthal et al.

The unconscious emotional behavior section consists of two chapters. Owren et al. focus on the affective content of vocalizations, and suggest that both the generation of affective vocalizations (in the sender), and their perception and recognition (in the receiver), can be unconscious, “implicit”, thereby enabling unconscious communication, often via acoustic properties alone (e.g., harsh vs. soft sound). Bouton focuses his discussion of affective processing within the context of animal classical conditioning, and discusses how classical conditioning processes mediate the generation of two affective states: panic and anxiety.
The experience of emotion section consists of two provocative chapters discussing how both conscious and unconscious processes help shape the subjective experience of emotion. Charland considers the construct of valence in depth. He first distinguishes among the different meanings of valence: valence as a component of the subjective feeling state, e.g., one of the two components of core-affect (the other being arousal), and valence as an assessment of a particular emotion as desirable/pleasant/appropriate. Charland suggests that valence is not an inherent property of the stimulus, nor the result of an initial evaluation by the unconscious affective circuitry (a view consistent with the core affect perspective, as well as with most appraisal theories), nor the result of a conscious evaluation of the feeling experience (as Lambie and Marcel propose). Instead, he suggests that valence is “indeterminate until it is fixed by attention”, but emphasizes that the very act of attending to the affective experience can change it.

Barrett argues against emotions as distinct ‘natural kinds’, and causal entities, although they are thought of, and investigated, as such. Rather, she argues that “research has not established strong evidentiary basis for the idea that anger, sadness, fear and so on constitute natural kinds of emotion that cause behavior or experience“ (p. 258). Similarly to Niedenthal et al., she suggests that the perceptual processes involved in emotion generation in the self are the same ones as those involved in perception and recognition of emotion in others (p. 263), and emphasizes the critical role of perception of the bodily states (embodied emotions) in defining the affective experience (similarly to the James-Lange feeling theory), as well as the central role played by core affect, an undifferentiated affective state defined by arousal and valence.

The concluding section provides five broader perspectives on the conscious-unconscious debate. Smith and Neuman discuss the role of two processes mediating appraisal and emotion regulation: associative (automatic) and rule-based (controlled), and discuss prominent appraisal theories in terms of their dual-process distinction, focusing on the theories of Leventhal & Scherer, and Clore and Ortony. They also relate their dual-process model to LeDoux’s low (amygdala mediated) vs. high (cortex mediated) road to emotion. They discuss the relevance of these different processes to emotion regulation and psychopathology. Scherer’s discussion emphasizes that the characteristic, and indeed defining, feature of emotions is synchronized activation of multiple subsystems; e.g., cognitive (evaluation), physiological (preparation for response), behavioral (execution of response). He discusses the appraisal processes that evaluate stimuli for their affective relevance, defined in terms of individual but interacting stimulus evaluation checks, each providing an evaluation (largely unconscious) in terms of a particular appraisal variable; e.g., goal relevance, goal congruence, coping ability. The resulting vector of appraisals then defines the corresponding emotion. While Scherer’s theories are typically categorized as cognitive appraisal theories, emphasizing the cognitive evaluation component, the focus of his discussion here is on the broader component process model, which emphasizes the synchronous activation of multiple modalities. Winkelmann et al. focus on the nature of the conscious feeling associated with emotion, and argues that unconscious (unfelt) emotion is possible, and thereby commits the first sin in the study of consciousness (see discussion of Clore et al. below). Their argument rests on the fact that emotions can be elicited without awareness, that expressive manifestations of emotion can occur without awareness (e.g., facial expressions), that unconscious emotions can influence behavior, and that the content of many of the pathways mediating affective processing cannot be available to awareness (e.g., subcortical pathways). Prinz, like Niedenthal and Barrett, emphasizes the necessary role of perception of bodily states for the emotion experience, citing empirical evidence regarding activity in the neural structures that mediate body perception during emotional episodes (e.g., anterior cingulate cortex, insula and somatosensory cortices), and in effect suggesting that emotions are per-
ceptions of bodily states, again, similarly to the James-Lange feeling theories. He argues that emotions, like other perceptions, can therefore be unconscious. Clore et al. conclude this section with a well-reasoned, if at times controversial, manifesto against the “Seven sins in the study of unconscious affect” (p. 384). Like Scherer (and others), they define emotions as evaluative states mediated by synchronous activation of multiple subsystems. They argue that emotions cannot be unconscious, because the consciousness arising from the synchronous activation of multiple evaluative systems is the defining feature of emotions, and critical to Clore’s theory of affect-as-information. At the same time, they acknowledge that the majority of affective processing occurs unconsciously. Some of the other sins discussed include the following: “unconscious emotional stimuli are stronger than conscious ones” (p. 387), “expressive actions have fixed effects” (p. 397), and “low-route stimulation causes emotion” (p. 399).

2. DISCUSSION

Several themes recur across multiple chapters in the book, and in many cases divergent views are expressed. Below I attempt to provide an integrated view of these themes, highlighting areas of agreement as well as those where opinions diverge. I also try to place the discussion with the broader context of the rapidly evolving area of affective modeling.

2.1 Embodiment and the Resurgence of Feeling Theories

Perhaps the most striking aspect of this volume is the emphasis on the embodied aspects of emotions by a number of authors who argue that the perception of the bodily states manifesting an emotion is a critical, if not a defining, aspect of the affective experience (e.g., Niedenthal et al.; Barrett, Prinz). The original James-Lange feeling theory emphasized the key role that perceptions of bodily states play in the emotion experience. Indeed, James defined emotion precisely as that perception, and reversed the generally accepted causality relationship between emotion and its expressive and behavioral components. He argued that we don’t run because we are afraid, but rather we experience fear because we are already running (James, 1884).

The apparent resurgence of feeling theories is accompanied by a relative lack of discussion of cognitive appraisal: a perspective that has dominated emotion research in psychology, and in symbolic computational models of emotion. For example, the section on ‘Cognition and Emotion’ does not include a contribution from a cognitive appraisal theorist (although there are two chapters in the concluding section those focuses on appraisal (Scherer, Smith, & Neuman)).

The resurgence of interest in the embodied aspects of emotion is perhaps not surprising, given the current emphasis in affective neuroscience on neurophysiological components and correlates of emotion, coupled with evidence that expressive manifestations of emotions alone can often trigger or enhance a felt emotion; e.g., the ‘facial feedback’ theories espoused by Darwin, Tomkins, Ekman. Nor is it inappropriate to broaden our perspective on emotion, particularly emotion generation and elicitation, beyond the often constricting lens of cognitive appraisal. Nevertheless, one wonders whether the cognitive revolution that began in the 1960’s, and the associated dominant role that cognitive appraisal has played in emotion research in psychology, is coming to a close, and is being replaced, for better or worse, by the embodiment revolution (see below).

What is surprising is that many of the original, and still valid, criticisms of feeling theories are not discussed by the proponents of the embodied theories of emotion. Most notably, Cannon’s criticism of the James-Lange theory that focused on several arguments, such as: disconnection of visceral inputs from CNS does not eliminate emotions, same ANS patterns characterize different emotions, visceral changes are too slow to account for affective reactions, artificial stimulation does not produce an emotion, and the visceral system states alone
are not sufficiently differentiated to account for the wide variety of nuanced emotions that can be experienced (Cannon, 1929). While Cannon’s objections were focused on ANS activation, and the current embodied emotion theories are cast more broadly, nevertheless, these objections should be considered in the current theories of embodied emotion.

2.2 The Embodiment Revolution?

Researchers attempting to elucidate the nature of cognition have, until recently, tended to view cognitive processing as the dis-embodied manipulation of symbols. This brain-in-a-vat view, emphasizing abstract, amodal processing, decoupled from peripheral sensory inputs and motor outputs, is now being challenged by the embodied cognition perspective. Embodied cognition theories emphasize the critical role that sensorimotor processing and representations play in higher-level cognitive processing (Wilson, 2002; Barsalou, 2008). Associated with this view is the increased emphasis on the role of modality-specific processing (vs. processing of amodal symbolic information), and the view that (aspects of) cognition may be mediated by re-enactment of modality specific “memories”, rather than by the manipulations of amodal, abstract, symbolic representations that have been extracted (transduced) from the low-level, modality-specific representations.

The discussion of embodied emotion above represents an analogous shift in emotion theories, from the cognitive appraisal theories to embodied emotion theories. The former emphasize the critical role of cognitive (though not necessarily conscious!) evaluation of the eliciting stimuli in emotion generation. The latter emphasize the critical role of the somato-sensory and motor representations associated with emotion; specifically, they suggest that it is the perception of these states that defines the affective experience, and also mediates emotion recognition in social contexts, as well as reasoning about emotions.

Enlarging our perspective on emotion to emphasize modalities other than cognition is of course a welcome development. It would, however, be a mistake to replace the previously dominant role of cognition with a dominant role of perception of embodied affective states. Rather, we should strive for a synthetic view where the roles of all of the multiple modalities comprising emotion are considered, and the relationships among them explored, with an emphasis on identifying causal dependencies.

2.3 Emotions Are Multimodal Phenomena

A puzzling aspect of several chapters in this book is the continued emphasis on identifying a specific single modality as the apparent sine qua non of emotion, or statements attempting to determine which is the key defining component of emotion (e.g., Niedenthal et al.’s “it is, above all, necessary to decide whether an emotion is a bodily state, a feeling state, or both”, p. 23). This is particularly surprising given that most authors acknowledge in their definitions of emotions that a critical aspect of emotions is precisely their multimodal nature. Indeed, several authors (e.g., Scherer, Clore) argue that the synchronous activation of the multiple systems is the defining feature of emotion, and one that differentiates affective from non-affective states (Scherer, p. 330).

One danger of this, often implicit, emphasis on a single component or modality is that it gives rise to misleading questions or assertions about the relationship between emotion and consciousness. For example, if we designate the subjective conscious awareness of emotion as its defining characteristic, then, by definition, emotion cannot be unconscious. Conversely, if we designate the subcortical processing in the amygdala as the defining component of emotion, then, by definition, emotion cannot be conscious. This emphasis on single components of emotion has a complementary problem, the reification of emotion, which is addressed below.

2.4 Emotions: From Reified to Non-Existent

The search for the defining component of emotion outlined above neglects the fact that
since emotions consist of multiple systems, it may not be meaningful to equate them with only a subset of those systems, or to frame questions about emotions as a whole. (But see discussion of Clore’s view.) As many emotion researchers have pointed out over the years, the term emotion does not refer to a uniform entity (e.g., “Emotion is too broad a class of events to be a single scientific category” (Russell & Barrett, 1999, p. 805)). In fact, Barrett (in this volume) goes further than this and proposes a radical solution to the problem of emotion reification. She argues that emotions do not exist as distinct ‘natural kinds’, but are instead perception-driven constructions, based on the experience of an undifferentiated core affect (reflecting current arousal and valence), and influenced by conceptual knowledge about emotions (p. 256). As discussed above, Barrett argues against emotions as natural kinds by presenting evidence of a lack of unique 1-to-1 mappings between particular emotions and their manifestations within a specific modality. The problem with this argument is that it appears to ignore the fact that emotions are inherently and essentially multi-modal. While there may not exist a unique mapping between a given emotion and its manifestations within a single modality, there likely are such mappings when all of the modalities are considered, including the cognitive content. It is this unique configuration of the multiple systems that then gives rise to what we recognize as distinct emotions, in ourselves, and in others.

Yet the reification of emotion is alive and well in the emotion literature, exemplified by the persistent question whether emotions can be unconscious. Given the complexity of affective phenomena, and the processes that mediate them, it is highly unlikely that any particular quality can be attributed to all of the components of emotions, whether it be awareness or lack thereof, control by cognition or inability to do so, etc. It may therefore not be appropriate to discuss ‘emotion’ as a uniform entity that can be described in terms of a series of binary properties. Instead our questions about emotions should be much more specific, focusing on individual structures and processes that together mediate the generation, experience and consequences of emotions. The question regarding the possibility of unconscious emotions should be more usefully reframed, as follows: which aspects of emotions are necessarily unconscious, which are necessarily conscious, which can be either, and what is the causal role of the conscious aspects of emotions. These are of course the core topics of this book and are addressed below.

2.5 Relevance for Computational Modeling of Consciousness and Emotion

This volume provides an excellent resource for understanding psychological and neuroscience research on emotion and consciousness. While the term ‘model’ is used extensively throughout the book, from a computational perspective, many of the models presented would more appropriately be referred to as theories. In general, it is important to recognize that the term ‘model’ means very different things to social or experimental psychologists, and to computational modelers.

A key question for the computational modeling community is then whether the theories presented are elaborated to a sufficient degree to enable the construction of computational models. Does the discussion offer useful deconstructions of high-level constructs such as ‘emotions’ and ‘consciousness’ to enable an identification of concrete representational entities for modeling? Are sufficient data provided to enable the modeling of specific processes and their dynamics?

In this regard, there is wide variability among the theories and data provided in the different chapters. Some promise detailed mechanisms but provide only high-level descriptions. Others do provide much detail, both with respect to supporting empirical evidence, and with respect to the level of detail to which their theories are elaborated. Most chapters offer useful deconstructions of many of the aggregated terms that are typical in emotion research (e.g.,
‘emotion’, ‘appraisal’). In addition, several chapters demonstrate a computation-friendly orientation and use computational terminology (e.g., Gray, Smith & Neuman, Scherer), exemplifying a promising trend in psychological theories to provide more mechanism-focused descriptions. Finally, the embodied theories of emotion provide interesting suggestions regarding the potential use of affective mechanisms in emotion recognition and in reasoning about emotion, as well as suggestions of novel mechanisms for affective processing. The latter include applying pattern recognition and computer vision techniques to simulations of perceptual processes involved in embodied emotions, and using modality-specific ‘situated’ processes to simulate the use of embodied emotion representations in reasoning about emotion, as proposed by Barrett. I briefly discuss examples of these topics below.

Computationally-Oriented Deconstruction of Concepts

A number of authors address the historical use of highly-aggregated terms and false distinctions, and emphasize the importance of developing more nuanced and differentiated vocabularies. For example, Clore et al. point out that the categories ‘implicit’ vs. ‘explicit’ (applied to memory) were developed to reflect different measures, and do not imply distinct memory systems. Gelder and Smith & Neuman warn against the assumption that ‘automatic’ is synonymous with ‘unconscious’ (p. 141, 288). Gray et al. provide detailed analysis of attention in terms of different types (endogenous and exogenous), and stages (capture, maintenance, release) (p. 83), discussing their relationship with emotion. Such differentiated accounts of mental phenomena are precisely what is necessary to support computational modeling and the Gray chapter is a good example of the level of detail necessary to support the development computational models.

Computation-Friendly Theories

Several chapters cast their theories in computation terms, thereby facilitating the translation to computational models. For example, Gray et al. discuss the primary role of emotions as mechanisms solving the control dilemmas that arise in systems whose computational complexity allows indeterminacy, in contrast to, for example, homeostatic mechanisms where such states cannot arise; e.g., thermostat (Gray et al., p. 85).

Smith and Neuman’s discussion of dual-processing in emotion elicitation and regulation not only provides useful suggestions regarding the different roles of these distinct processes. Another example is Scherer’s ‘design feature’ based set of definitions of different affective states (p. 315), as well as his elaboration of the cognitive appraisal process in terms of distinct appraisal variables, whose values are determined by a series of processes (stimulus evaluation checks). Scherer’s appraisal theory serves as a basis for a number of computational models, both research-focused and applied.

Modeling Perception-Based Embodied Theories of Emotion

The emphasis on the critical role of perception of sensory-motor states in emotion generation and recognition presents a challenge to the modeler, both from a theoretical, and a practical perspective. How should we model embodiment in software entities? Can embodied theories of emotion serve as a basis for augmenting reactive robotic architectures with synthetic emotions?

At the same time, these perception-based theories suggest interesting possibilities to explore for emotion recognition, for models of emotion contagion, and models of reasoning about emotion. Niedenthal et al. and Barrett suggest that the processes involved in emotion perception in the self are the same as those involved in emotion perception in others, mediated, in part, by the unconscious activation of facial expressions. Embodied robotic architectures may provide platforms within which these theories can be further elaborated and evaluated. Prinz’s proposal of a 3-level hierarchical organization of the perceptual processes interpreting somatosensory / motor states (pp. 369-370) provides an interesting starting point for implementing embodied theories of emotion, as do suggestions
that techniques from computer vision may be applicable to modeling the perceptual processes involved; e.g., “to keep track of this sequence of bodily events, the brain must register patterns of bodily response – not unlike the level in visual processing in which edges are bound together into shapes and contours” (Prinz, p. 370).

Researchers in the cognitive and affective sciences are increasingly emphasizing the need to consider emotion and cognition conjointly, in both experimental and computational modeling approaches. The material presented in this volume suggests that models of emotions should similarly be considered conjointly with models of consciousness. Indeed, perhaps it is not possible to understand these apparently closely related phenomena separately.

3. CONCLUSION

This book should be read by anyone with an interest in constructing computational models of emotion. It provides a coherent summary of existing research, represents an excellent resource for a broad range of empirical data (both psychological and neurophysiological), and introduces a number of novel and intriguing ideas, which can be further explored and evaluated via computational modeling.

More than a hundred years ago James pre-sciently observed that to understand emotions we must move beyond descriptive taxonomies and focus on identifying the causal mechanisms mediating these phenomena. Some of the suggestions outlined above would help provide the foundations for a systematic, multi-disciplinary, and computation-oriented approach to elucidating the processes that give rise to the conscious experience of emotion, and its causal role in the processes that enable complex adaptive behavior.

REFERENCES


