

David Huron, *Sweet Anticipation: Music and the Psychology of Expectation*. Cambridge, MA: MIT Press, 2006. ISBN-10: 0-262-08345-0; ISBN-13: 978-0-262-08345-4 (hardcover) \$40.00

Editor's Note: This review is written from a cognitive psychologist's perspective. A second review, written from a musician's point of view, may be found on pp. 65-66 of this issue.

David Huron's superb book *Sweet Anticipation: Music and the Psychology of Expectation* (2006, MIT Press, Cambridge, Mass, 462 pp) is an exceptional contribution to the field of music cognition and represents a clear advance in our understanding of the role of expectancy in music experience. Ironically, the appearance of the book was difficult to anticipate. David Huron's publications have not generally focused on issues of musical expectation, so an entire book dedicated to the issue was surprising. However, readers will encounter many themes that reflect Huron's longstanding interest in statistical properties of music and evolutionary accounts of musical behaviors. Indeed, as the book progresses readers will find that the topic of expectation provides a fascinating and powerful account of much of the research reported by the author over the past few decades.

Huron begins by asking why it is that music is so successful in evoking emotions when its capabilities for representing the natural world are so constrained. He acknowledges Meyer's (1956) seminal work of 50 years ago, *Emotion and Meaning in Music*, in which Meyer argued that the principal emotional content of music arises through the composer's manipulation of expectation. Huron explains that at the time Meyer presented his views on music and emotion, there was little relevant psychological research to draw on. With this idea in mind, the stated aim of the book is to revisit Meyer's topic and to recast the discussion in light of contemporary findings.

The essence of the book is a psychological account of expectation called the ITPRA theory. Each letter of ITPRA stands for one of five proposed categories of expectation responses: imagination, tension, prediction, reaction and appraisal. The five response systems can be grouped into two periods or epochs: pre-outcome responses (feelings that occur prior to an expected / unexpected event) include the imagination and tension responses; post-outcome responses include the prediction, reaction, and appraisal responses.

The imagination response entails contemplating potential future states and acting in a way that makes those states more likely if they are positive, and less likely if they are negative. Imagining an outcome is a principal motivator of behavior. Musicians who imagine the experience of stage fright prior to a performance are more likely to put in extra hours of practice. Without the imagination process, individuals would fail to take steps to avoid negative outcomes. Evidence suggests that imagination response induces actual emotional states while retaining awareness that the event that would lead to that state has not actually occurred.

The tension response is a more immediate physiological preparation for an imminent event and involves changes in arousal. Classic behaviors associated with the tension responses include fighting, fleeing, and freezing. The tension response is activated immediately before an anticipated moment of outcome, and adjusts the level of arousal and attention according to the degree of uncertainty surrounding the outcome, the significance of potential outcomes, and the estimated time before the outcome occurs.

Post-outcome responses include prediction, reaction, and appraisal responses. Prediction responses are transient states of reward or punishment that arise in response to the accuracy of expectation. Accurate expectations are rewarded by positively-valenced emotional responses, and inaccurate expectations are punished by negatively-valenced emotional responses.

Both the reaction and appraisal responses are emotional states that arise from assessments of the event itself independent of whether that event was anticipated. The reaction response is a rapid process that occurs automatically and preattentively and activates bodily actions and / or visceral responses. Reaction responses are knee-jerk reactions but are not always instinctive reflexes; they can also be learned. Appraisal responses are more considered and conscious assessments of an outcome, and need not be compatible with the reaction response.

As a cognitive psychologist, I find Huron's proposals for expectancy mechanisms and their possible evolutionary origin convincing and novel. Indeed, throughout the book musical issues are connected with human psychology in a way that reflects a deep and nuanced understanding of both disciplines. The capacity to form accurate expectations about future events clearly confers a significant biological advantage, and it is entirely reasonable to assume that multiple systems evolved. The theory aims to account for not just music; but all psychological phenomena related to expectation.

Huron is a compelling writer with a strong interdisciplinary background, and readers will find his examples, anecdotes, and explanations continuously interesting and often amusing. For example, the biological function of expectation is discussed using a detailed description of the operation of commercial energy producers. All biological organisms use energy to move muscles, maintain metabolism, and form thoughts. As with the electrical grid, the amount of energy required by an organism changes from moment to moment. In explaining the fast and automatic “tension” responses that generate those annoying startle responses to events such as the sound of a door slamming – even after repeated hearings and knowing there is no danger – Huron likens the automatic alerting response to “a grumbling naysayer.”

Critical to the theory is the connection between expectation and affective states. The author makes it clear that expectancy is only one source of musical emotions, and does not attempt a comprehensive explanation of the connection. Only some emotional qualities of music originate as affective responses generated by expectancy mechanisms. Nonetheless, these affective responses are particularly salient because their biological purpose is so fundamental: to prepare an organism for the future.

At the most basic level, expectations are associated with feelings of anticipation and, if these expectations are violated, surprise. Through evolution, emotions have become associated with expectancies because emotions act as “motivational amplifiers” that encourage organisms to pursue behaviors that are adaptive and to avoid behaviors that are maladaptive. Put simply, emotions function to reinforce accurate prediction, promote appropriate event-readiness and increase the likelihood of future positive outcomes. Positive feelings reward states deemed to be adaptive, and negative feelings discourage states deemed to be maladaptive. Music making taps into these primordial functions to produce a wealth of compelling emotional experiences.

Huron’s discussions of the relation between emotion and expectancy have the potential to advance our understanding of music and emotion in at least three ways. First, previously unexamined emotional responses to music, such as humor, frisson and awe, are discussed at length and grounded in plausible psychological and evolutionary explanations. Second, although researchers have identified associations between structural attributes of music and emotional connotations, these associations are often left unexplained. The ITPRA theory has the potential to account for many of these associations through an analysis of the expectancy responses triggered by such features. Third, the distinction between perceived and felt emotion, which has received considerable attention in recent years, can be readily explained by the operation of different expectancy responses.

Some prospective readers may wonder how Huron’s theory of expectancy relates to another influential theory of musical expectation – Narmour’s *implication-realization* (IR) model. In *The Analysis and Cognition of Basic Melodic Structures*, Narmour (1990) extended his earlier discussions of melodic implication by proposing a novel yet comprehensive approach to music analysis based on melodic structures that are formed through expectations for various events along with perceptual responses to realized events. Narmour develops his arguments from a core set of axioms almost in the form of a mathematical proof, and ultimately construes melody as an assemblage of elementary melodic structures that can be identified on multiple hierarchical levels. Individual melodic structures consist of only a few sequential notes and are thought to emerge from innately determined melodic implications. Narmour’s insisted that the basic principles of implication that generate melodic structure are innately determined and reflect Gestalt-like laws of form. This claim suggests that the model should be applicable to all melodies: Western tonal, post-tonal, pre-tonal, and non-Western.

Whereas Narmour erects his IR model using a core set of Gestalt laws of perception as his building blocks, Huron makes no attempt to adopt an axiomatic approach and instead draws upon broad evolutionary explanations for expectancy responses. His detailed discussions of cognitive, biological and evolutionary principles are highly persuasive and deeply informed, and they do not require that readers accept unexplained “laws” of form. On the other hand, Huron’s avoidance of irreducible primitives makes his approach less applicable for the kind of finely detailed musical analyses that can be found in Narmour (1990). Unlike other major theoretical treatises on music (see also Lerdahl & Jackendoff, 1983), readers will find no moment-to-moment analyses of music based on the theory. It is unclear whether the ITPRA model could be used to analyze complex musical works into an elaborate sequence of more basic structures. The book offers no set of symbols that might be used in music analysis and issues of hierarchical structure are not addressed.

But Huron has never been one to walk through individual compositions note by note, preferring to examine broad statistical tendencies in music that can be observed across a large corpus of works. The statistical approach has proven remarkably powerful, and has been used to illuminate a number of

archetypal patterns in melody. As argued in the book, listeners are highly attuned to statistical regularities in the environment, and this attunement, coupled with psychological constraints and cognitive *short cuts*, gives rise to expectancies.

In some cases, attunement to statistical regularities can account for expectancies in a one-to-one fashion. Sequential pitches in music from various cultures typically form small melodic intervals and listeners correspondingly expect small intervals as they listen to music. The relation between expectation and statistical data is not always straight forward, however. Indeed, the chapter on statistical properties of music reveals a striking disjunction between what people expect to occur in music and what they should expect to occur based on induction of statistical regularities in the musical environment. Such discrepancies lead Huron to propose that the process of induction is shaped and filtered by cognitive constraints.

As an example, real melodies exhibit a tendency for step inertia (i.e., continuation of a step pitch pattern) for *descending intervals only*, but listeners expect step inertia for both ascending and descending intervals. Huron argues (based on a suggestion made by Paul von Hippel) that listeners over-generalize in forming their melodic expectations for step inertia, because such a strategy optimally balances accuracy of prediction with economy and speed of processing. Thus, organisms are designed to develop expectations based on a process of induction, but expectations must be formed rapidly and may reflect “quick and dirty” strategies for predicting statistical properties of the environment.

As another example, statistical analyses of large samples of music suggest that the classic “gap-fill” pattern discussed by Leonard Meyer (also known as the post-skip reversal) is actually a consequence of a more general tendency: regression to the mean. That is, pitches in real music exhibit the basic principle of regression to the mean, and consequently any large melodic leap will be followed by a reversal of pitch direction approximately 70% of the time.

People do not expect regression-to-the-mean; they expect post-skip reversals. Why would people expect post-skip reversals when such reversals only occur 70% of the time and are an artifact of regression to the mean? According to Huron, developing a regression-to-the-mean heuristic would be accurate but would entail continuously inferring the distribution of pitches as a melody unfolds, a process that would consume resources. A post-skip reversal heuristic would be accurate 70% of the time and would require no continuous updating of statistical information. Again, listeners appear to form expectancies by balancing the goals of accuracy of prediction and economy of resources.

Huron’s considered discussions of memory provide a promising framework for elaborating his theory of expectancy. Huron reminds us that a biological purpose of memory is to prepare organisms for the future, so it can usefully be construed as a kind of “readiness circuit.” At least three memory systems are thought to be involved in expectations: episodic, semantic, and short-term memory. Each system leads to a distinct form of expectation.

The sections on memory systems and their functions are highly informative, but they also draw attention to the awkward fit between conventional constructs in memory research and experiences of music. For example, knowledge of familiar tunes such as *Mary Had a Little Lamb* is cited in the book as an instance of *episodic memory* that is “no longer tethered to a specific past moment.” The characterization is strangely apt, even though episodic memory is typically *defined* by its connection to a specific learning episode. General knowledge of a song that is not tied to a learning experience would seem to fall outside of the domain of episodic memory. Once an episodic memory is dissociated from a particular temporal tag, it is a form of semantic memory, and in the case of song recognition it would be equivalent to recognizing a very long and melodious word. Memory is episodic when it is associated with personally experienced events that occurred at a particular place and time; it is a form of mental time travel that allows a person to re-experience, through autoeotic awareness, one’s own personal experiences. Neuroscientific research on music may eventually clarify whether memory for familiar songs is best characterized as episodic.

Expectancies are a form of *implicit memory* (Thompson, Balkwill & Vernescu, 2000), a simple point that has the potential to motivate refinement and elaboration of the ITPRA theory. Implicit memory is characterized in the book as “difficult to describe verbally and difficult to recall through conscious effort.” But the phenomenon of implicit memory does not refer to memories that are *difficult* to recall; it refers to psychological effects of stimulus exposure that do not *rely on* conscious recollection of the original exposure. Implicit memory for a stimulus can (and often do) occur concurrently with explicit memory for that very same stimulus, even though the two forms of memory arise independently of one another. Thus, repeated exposure to a melody may lead a person to recognize the music while independently experiencing a “mere exposure effect” (a phenomenon that Huron accounts for persuasively).

The penultimate chapter confronts the issue of musical modernism, addressing such composers as Richard Wagner, Arnold Schoenberg, and Igor Stravinsky. Huron argues that there is an essential psychological dimension to modernism. Specifically, many of the musical devices used by modernist composers are explained as serving the goal of psychological *disruption* through intentional violations of conventional expectations. This interpretation of modernism as merely contrarian is likely to generate at least some level of objection, but it is clear that the idea was developed out of a rich understanding of musicology, modernism, and cognitive science.

The book closes with a valuable summary of the ITPRA theory and a discussion of the implications for composition, performance, musicology, ethnomusicology, and musical aesthetics. On the whole, Huron provides an extraordinarily rich analysis of the phenomenon of musical expectation and provides a persuasive account of its psychological sources. *Sweet Anticipation* is without question one of the most exciting pieces of scholarship to emerge in the past decade, and should be read by anyone with a serious interest in the psychology of music.

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