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Psychological Anticipation

The ITPRA Theory

Abstract: *A summary of the ITPRA theory of expectation is presented (Huron, 2006). The theory aims to explain the complex dynamic blend of feelings commonly evoked by unfolding events. The theory posits five response systems divided into pre- and post-outcome epochs. Pre-outcome responses include* imagination *(I), where contemplating future possibilities enables vicarious pre-viewing of likely future feelings as a strategy for choosing current behaviours.* Tension *(T) refers to feelings associated with somatic preparations immediately preceding an anticipated event. Post-outcome responses include* prediction *(P) where positive or negative feelings arise in response to predictive accuracy, with the aim of improving predictive models.* Reaction *(R) refers to feelings arising from neurologically fast responses such as the startle response. Finally,* appraisal *(A) refers to feelings arising from neurologically slow cognitive assessments of the final outcome. The theory proposes that all five systems contribute to a dynamically evolving cocktail of feelings evoked by unfolding events.*

The ability to anticipate future events is essential for survival. Any effort to understand anticipation, expectation, or prediction should include a recognition of the biological utility and origin of these functions. Neuroscientific studies indicate that large regions of the brain are implicated in prediction. For example, EEG studies have established that the brain is acutely sensitive to surprise. More than one author has characterized the brain as principally a prediction device. Minds are 'wired' for expectation (e.g. Bar, 2007; Clark,

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2015a; Damasio, 1994; Edelman, 1993; Fenk and Fenk, 2011; Sharpe and Schoenbaum, 2016).

Brains don't simply engage in prediction or forecasting. Accompanying the biological functions are distinctive phenomenological experiences. What happens in the future matters, so it should not be surprising that how the future unfolds has a direct effect on how we feel. A central question, then, is why precisely do expectations evoke the various feeling states they do? What is the link between the evolved physiological mechanisms for anticipation, prediction, and forecasting and their associated subjective experiences?

1. Musical Inspirations

For over half a century, the phenomenon of expectation has been an active area of research in the field of music psychology. Like many arts, music holds a remarkable capacity to evoke a wealth of vivid emotions. However, unlike most arts, music offers many fewer opportunities to evoke emotions through representational or narrative means. Although music may sometimes portray recognizable stories or convey symbolic meanings, most instrumental music (in particular) seems devoid of any clear human narrative. In such circumstances, how is music able to evoke such powerful emotional responses when the building blocks of music consist predominantly of abstract non-representational sounds such as pitched tones?

In his 1956 book, *Emotion and Meaning in Music*, the eminent musicologist Leonard Meyer drew attention to the role of expectation-related phenomena in musical experience and enjoyment. Meyer suggested that much of music's allure lies in the musician's manipulation of listener expectation — either matching, thwarting, delaying, or anticipating what the listener expects. Inspired by Meyer's work, many music scholars (both analytic and empirical) have turned their attention to music-related expectation (e.g. Cuddy and Lunney, 1995; Schellenberg, 1996; Schmuckler, 1997; Narmour, 2000; Schellenberg *et al.*, 2002; Margulis, 2005; Pearce and Wiggins, 2012; Collins *et al.*, 2014; Vuust and Frith 2008).

Of course, any theory of music-related expectation will surely draw on a general understanding of expectation as an ever-present aspect of psychological life — not simply limited to music. In the course of sustained efforts to understand the role of expectation in music listening, Huron (2006) proposed a general theory of expectation — the ITPRA theory. The aim of the theory is to account for the

psychological feeling states evoked by various expectation-related circumstances. The main purpose of this article is to describe this theory for a non-musical audience.

2. Five Systems

The ITPRA theory suggests that expectation-related emotions or feelings arise via five functionally distinct psychophysiological systems dubbed *Imagination*, *Tension*, *Prediction*, *Reaction*, and *Appraisal* (ITPRA). Each of these systems serves a different purpose and is able to evoke responses independently. The responses involve both physiological and psychological changes. Some of these changes are autonomic and might entail changes of attention, arousal, and motor movement. Others involve noticeable cognitive changes such as pensive rumination or conscious rational analysis. All evoke different affective responses.

Tomkins (1980) argued that the function of emotions is to act as motivational amplifiers. Positive and negative feelings provide the carrots and sticks that encourage states deemed adaptive. The word 'deemed' here is important. Positive and negative feelings are evoked, not by outcomes that are objectively adaptive or maladaptive. Instead, these feelings arise from brain processes, shaped by natural selection, that *presume* certain outcomes to be adaptive or maladaptive. In some circumstances the evoked emotions are misplaced. For example, a pet dog or cat may experience acute distress when being taken to the veterinarian — despite the fact that the medical attention objectively increases the animal's health. At a surprise party, the surprised person may experience an initial feeling of intense terror that is subsequently displaced by a feeling of celebratory joy.

Each of the five response systems in the ITPRA model makes different assumptions about what constitutes a good or bad outcome. Consequently each of the five systems offers a range of possible affective states that can be evoked. As we will see, unfolding events (both surprising and anticipated) can evoke distinctive mixtures of subjective experiences depending on the cocktail of feelings evoked by the combination of all five response systems.

The five response systems can be grouped into two periods or epochs: *pre-outcome* responses (feelings that occur prior to an expected/unexpected event) and *post-outcome* responses (feelings that occur after an expected/unexpected event). Pre-outcome responses include the 'imagination' and 'tension' responses.

3. Imagination Response

Even in situations of high uncertainty, outcomes may or may not lie within our control. If it rains, you might get wet; but if you carry an umbrella you can reduce the probability of that outcome. In other words, people have no control over 'rain', but we sometimes have control over 'getting wet'.

Through a simple act of *imagination*, future outcomes can be made emotionally salient. The resulting feelings motivate changes in current behaviour that can increase the likelihood of a future favourable result (see March, 1978; Klinger, 1990; Loewenstein and Schkade, 1999). For example, you might decide to undertake a challenging journey as a result of imagining the pleasure of being reunited with a loved one. Or you might choose to work overtime because you can imagine the embarrassment of having to tell your boss that a project remains incomplete. That is, *imagining* an outcome allows us to feel some vicarious pleasure or displeasure, as though that outcome has already occurred. This *imagination response* is one of the principal mechanisms in behavioural motivation. It is the process of imagining the discomfort of being wet that encourages one to carry an umbrella when a weather report predicts rain.

The inability to 'foretaste' future emotions is evident in a clinical condition described by neurologist Antonio Damasio. One patient ('Elliot') suffered mild brain damage that left intact all other functions — except the ability to anticipate the feelings associated with various possible future scenarios (Bechara *et al*., 1994, described in Damasio, 1994, pp. 212–17). When a negative outcome was imminent, Elliot was cognitively aware of the likely deleterious consequences. However, he was not motivated to take steps to avoid the negative outcome because the future negative feelings were not palpable and did not seem to matter.

When we imagine future scenarios, we commonly experience muted versions of the emotions associated with different outcomes. We don't merely *contemplate* future possibilities; we *feel* future possibilities. When this ability is lost, we are unable to forgo immediate pleasures as the cost of achieving a greater pleasure later. In short, the *imagination response* provides the biological foundation for deferred gratification. Imaginative *thought* allows us to glimpse the great pleasures that await us if we are willing to work towards those ends. But it is imaginative *emotions* that motivate us to persevere through hardships in order to reach those desirable states.

From time to time, pop psychologists and self-appointed spiritual advisors have advocated that people focus on living in the present and let go of their concerns for the future. Damasio's patients have achieved precisely such a state. For these individuals, the future is a grey abstraction that is irrelevant to their lives. As a consequence, they go bankrupt, lose their friends, and live lives in which present-tense joys become increasingly hard to achieve because they are unable to plan ahead (Huron, 2006, p. 9).

While imagining the future can help us choose behavioural paths that anticipate positive consequences, it should also be noted that reflecting about future scenarios can also draw attention to a person's lack of control. There are some future events (like death) that are inescapable, and so imaginative responses can sometimes lead to feelings of futility or impotence.

4. Tension Response

At a party, a friend approaches you with a balloon in one hand and a sharp pin poised for action in the other hand. The alcohol-induced grin on your friend's face suggests that the balloon is not likely to remain inflated for long. You squint your eyes, put your fingers in your ears, and turn your face away.

When an anticipated event approaches, we may engage in a variety of preparatory behaviours. These can include motor preparations (such as opening a hand in advance of receiving an object), perceptual preparations (such as directing our gaze in a particular direction), visceral preparations (such as increasing heart rate), attentional preparations (such as focusing on one voice in a crowd of many voices), and cognitive preparations (such as thinking what one might say). The purpose of these behaviours is to help us react more quickly and effectively in response to an anticipated event. All of these mental and physical preparations fall under the rubric of the second pre-outcome emotional response that ITPRA dubs *tension.*

Like the imagination response, the tension response is limited to the pre-event epoch. Although imagination responses may occur hours, days, or years in advance, the tension response tends to be limited to a relatively brief period immediately prior to an anticipated event or circumstance. The evoked feelings associated with the tension response are linked to the specific preparatory behaviours.

Tension responses can arise from simple conditioned responses such as salivating in advance of receiving food. However, anticipatory

tension responses can also involve highly sophisticated forms of learning and inference, such as anticipating when a speaker can interject during animated conversation: in conversational turn-taking, people unconsciously alter their respiration so that conversational openings coincide with full lungs.

Simply flexing muscles in anticipation of catching a ball will change a person's feeling state. The evoked feelings will depend on which muscles are flexed. Flexing abdominal muscles will tend to evoke a different affect than squinting eyes, smiling, or clutching a steering wheel (Huron, 2006).

The class of feelings that arise from self-perception of corporeal states has a long history going back more than a century. In a famous passage, William James suggested that fear was evoked by the act of trembling, and that sorrow was evoked by the act of crying (James, 1884, p. 190). Modern research provides qualified support for such experiences. By itself, the so-called James-Lange theory does not account for all emotions or feeling states. Nevertheless, there does indeed appear to be a class of feelings whose origins can be found in self-perception of postural, motoric, visceral, or other corporeal states (i.e. somatosensation, interoception, and proprioception). A comprehensive review of this literature can be found in Laird's (2007) book, *Feelings: The Perception of Self*.

When preparing for an event, our mental, visceral, and motor preparations are confounded by two forms of uncertainty — uncertainty about *what* will happen, and uncertainty about *when* it will happen. When we are uncertain of the timing of an event, we are likely to begin preparations just prior to the earliest anticipated moment when the event might occur. If the anticipated event is delayed, we might have to sustain our mental, visceral, and motor preparations for a considerable length of time. Apart from the uncertainty, feelings arising from the tension response are shaped by the importance of the various possible outcomes. Some anticipated events are relatively inconsequential, even under high uncertainty. In other cases, there may exist a marked difference between the best and worst plausible outcomes. Such differences can either amplify or attenuate the magnitude of the associated feeling state.

When we are uncertain of the specific outcome, we may need to be prepared for multiple possibilities. In a game of baseball, a fielder can watch the pitcher's preparatory wind-up and can plainly see whether the batter swings. There is little uncertainty regarding the timing of outcomes. Instead, the doubt exists mainly with the *what*: will the

batter succeed in hitting the ball? And if so, will the ball enter the fielder's zone of play? Although the probability of a batter hitting some pitch into the fielder zone is low, the fielder's optimum preparation will assume a hit into the fielder's area. For each wind-up of the pitcher, the fielder will need to adopt an appropriate mental and physical state. These preparations incur a cost. Even if the player never has to field a ball over the course of a game, the fielder is apt to be fatigued by game's end — as a consequence of repeated mental and physical preparations for events that never occur.

In other situations, uncertainty will attend the *when* rather than the *what*, but the most uncertain situations arise when both *what* and *when* are unknown. For example, a soldier on guard duty might have been warned to expect an enemy attack. Although no attack may occur, the increased arousal and vigilance induced by the expectation of an attack is likely to generate marked physical and mental fatigue.

Many of the physiological changes associated with anticipation are associated with stress. Of course, when anticipating a *negative* event, we are apt to experience considerable stress. However, even when the anticipated outcome is highly positive, some degree of stress remains present. Feelings of sweet anticipation are likely to be tempered by a nagging fear that something will go awry and the anticipated positive result may not actually come to pass. It is the frequent presence of corporeal and/or mental stress that accounts for the label *tension* response in the ITPRA theory.

5. Prediction Response

Once an event occurs (whether anticipated or not), the ITPRA theory proposes that three post-outcome responses are set in motion. One of these responses relates to the expectedness of the event. In general, organisms respond faster and more appropriately to events that are expected compared with events that are unexpected. When an event is expected, the individual is better able to evade dangers and to exploit opportunities. Clearly, accurate predictions are biologically more valuable than inaccurate predictions — whether or not the outcome is good or bad.

Since accurate prediction is beneficial, it is important to reinforce those mental models that lead to accurate predictions, and conversely, to modify or dismantle those mental models that lead to inaccurate predictions. Consequently, the *prediction response* tends to induce a positive feeling (reward) when an event is expected, and to induce a

negative feeling (punishment) when an event is unexpected. As noted, these responses are independent of whether the outcome itself is deemed good or bad. It is as though brains know not to shoot the messenger: accurate expectations are to be valued and encouraged even when the news is not good (Huron, 2006, p. 13).

Asking an employee to mail an important letter, the employer might predict that the employee is very likely to forget. In the event that the employee does indeed forget, the employer's disappointment is apt to be mixed with a certain satisfaction at having correctly anticipated the unfortunate outcome ('I knew it!'). In the early psychological literature related to expectation, this response was commonly referred to as the *primary affect* (Olson, Roese and Zanna, 1996; see also Mandler, 1975).

More recently, *predictive coding* models have proved compelling from both computational and neurophysiological perspectives (e.g. Clark, 2013; 2015b; Feldman and Friston, 2010; Friston, 2009; Hinton, 2007). High-level predictive models generate predictions of low-level sensory inputs; prediction errors are used to update the high-level models — provided the magnitude of the error exceeds typical statistical noise. Although not without problems (e.g. Kogo & Trengove, 2015), predictive coding has demonstrated notable success in emulating many aspects of mental processing (including various aspects of musical experience, e.g. Cheung *et al.*, 2019). Further discussion of prediction response can be found in Huron (2006; 2019).

6. Reaction Response

Once an outcome is known, we will necessarily experience emotions that reflect some sort of assessment of the new situation. We might experience 'disgust' when uncovering mouldy food, 'fear' when receiving notice of a tax audit, or 'joy' when encountering a close friend. Such emotional responses may occur only after the outcome is known. Two types of post-outcome responses can be distinguished. Joseph LeDoux and his colleagues have established that our reactions to events typically involve two different neural pathways — subcortical and cortical (LeDoux, 1996). This distinction has been generalized and popularized by Daniel Kahneman as *System 1* and *System 2* (Kahneman, 2011). System 1 is fast, automatic, stereotypic, unconscious, and typically features subcortical brain activity. System 1 responses are often (though not always) defensive or protective in function and commonly react under the presumption of a worst-case

scenario. System 2 is more leisurely, thoughtful, conscious, and features increased cortical brain activity.

When we respond to events, System 1 provides a 'quick-and-dirty' assessment of the situation that provokes an immediate somatic (bodily) response. System 2 provides a more reflective assessment of the situation — a response that takes into account complex social and environmental factors. In the ITPRA theory, these fast and slow responses are referred to as the *reaction response* and the *appraisal response* (see below), respectively.

A simple example of a *reaction response* is the reflex evoked when accidentally touching a hot object. The reflex will cause you to abruptly withdraw your hand. In fact, the motor response occurs with such speed that you have withdrawn your hand before the sensation of heat is registered in consciousness. Similarly, in the case of a surprise party, the initial response to the surprise is a short-lived startle or fear response. In both cases, the response has a fast onset, is not mediated by consciousness, and has a defensive function.

While reflexes are examples of reaction responses, most reaction responses arise from learned behaviours. Common behaviours become coded as perceptual, motor, and cognitive *schemas*. Language grammar provides a familiar example. Consider wrong with speak. Grammatical violations will generate a fast (System 1) surprise, even though grammar itself is clearly learned through exposure within some linguistic community. Responses to grammatical violations are hardly reflexes. Nevertheless, the rapidity and unconscious automaticity of the response testifies to their System 1 origins (Huron, 2006, p. 13).

Reaction responses are common when observing theatrical magic where spectators are surprised by various perceptual violations, such as an apparent defying of the force of gravity or visual transgressions of object continuity.

As noted, not all reaction responses are negatively valenced. Placing a candy in one's mouth, immersing cold hands in warm water, stroking a soft fabric, or turning on a light in a darkened room may all result in positive feelings with a rapid onset. Examples of positive reaction responses involving learning might include seeing a traffic light turn green, discovering a lost key, or hearing the voice of a loved one.

7. Appraisal Response

Our first reaction to some event is not necessarily the same as our final assessment. Following a quick and unconscious *reaction response*, slower conscious thought is engaged and we are able to form a more nuanced appraisal of the situation. For example, the initial joy of seeing a text message from a friend may be followed by acute embarrassment as you realize you were supposed to meet for lunch. Encountering a rattlesnake is likely to evoke an immediate feeling of fear. But for a herpetologist, the initial fear may be quickly followed by the joy of discovery. What we find initially good or bad may be completely transformed by subsequent assessments. When conscious thought is engaged, System 1 reactions are superseded by a System 2 *appraisal response*.

The *reaction* and *appraisal responses* are independent. As in the above examples, the two responses may produce contrasting negative and positive reactions. However, the two responses might also reinforce each other. For example, a quick reaction response might evoke a feeling of fear. The ensuing appraisal response might conclude that the situation is indeed dangerous, and so amplify the feeling of fear.

It is important to recognize that the appraisal response may entail a sequence of different assessments. With continued thought, a chain of appraisals may ensue as you work through the consequences of some situation. For example, in a chess game, an opponent's unexpected move may generate fear as you realize your knight is threatened. Moreover, the only evasive response would appear to result in a subsequent threat to your queen. However, as you continue to appraise the situation, you may realize that your opponent has failed to recognize the ultimate downstream consequences. At face value, the move appears to be a grave threat; however, you ultimately conclude that your opponent has made an onerous mistake. What begins as a chain of appraisals leading to heightened fear may conclude with a gleeful appraisal of advantage.

Finally, it is important to recognize that people may experience different appraisal responses for similar circumstances. For example, two retail employees may both be startled by the unanticipated ringing of their telephones. Following the initial surprise, the employee in the customer service department might experience a negative appraisal response since the call is likely to convey a customer complaint. By contrast, the employee in the sales department might experience a

positive appraisal response since the call offers the possibility of making a sale — with an accompanying commission. The two employees experience similar reaction responses, but contrasting appraisal responses.

In general, the difference between the reaction and appraisal responses can be traced to different physiological sources. Reaction responses are closely linked physiologically to System 1 (or sub-cortical processes) that involve no conscious thought. By contrast, appraisal responses are closely linked to System 2 (or cortical processes) that often draw on conscious thoughts involving complex social and contextual factors

8. The ITPRA Theory of Expectation

In summary, the ITPRA theory distinguishes five expectation-related response systems. Each system serves a different biological purpose and each system affords a unique palette of psychological feeling states. The purpose of the *imagination response* is to motivate an individual to behave in a way that increases the likelihood of future beneficial outcomes. The purpose of the *tension response* is to encourage somatic and mental preparations that are optimally tailored to the degree of uncertainty and the importance of an impending event. The purpose of the *prediction response* is to fine-tune the accuracy of predictive mental models by generating hedonic rewards in response to accurate predictions, and by generating hedonic punishments in response to inaccurate predictions. The purpose of the *reaction response* is to generate an immediate reaction under the assumption that a more accurate (cognitive) assessment of the situation may be too slow. The reaction response exists primarily to protect us from possible worst-case scenarios, however it may also arise as a way of ensuring that important positive opportunities are seized before the opportunity disappears. The purpose of the *appraisal response* is to generate the most appropriate and advantageous reaction to an event, taking into account all pertinent factors including social, environmental, and contextual considerations. Table 1 summarizes the five response systems, identifying how they are biologically adaptive, and specifying their approximate time-course.

Response System	Epoch	Biological Function
(I) imagination response	Pre-outcome	Future-oriented behavioural motivation; enables deferred gratification.
(T) tension response	Pre-outcome	Optimum somatic & mental preparations for anticipated events.
(P) prediction response	Post-outcome	Negative/positive reinforcement to encourage the formation of accurate expectations.
(R) reaction response	Post-outcome	Neurologically fast responses that assume a slow cognitive appraisal will fail to adequately handle dangerous or highly opportune situations.
(A) appraisal response	Post-outcome	Neurologically complex assessment of the final outcome that results in negative/positive reinforcements.

Table 1. From Huron (2006, p. 16).

A helpful way to understand the purpose of these five response systems is to reformulate the descriptions in terms of questions:

1. What do you think might happen in the future, and how do you feel about the various prospects?
2. Are you mentally and physically ready for what's about to happen? How do the preparations make you feel?
3. Were you able to accurately predict the final outcome? How does the success or failure of your prediction make you feel?
4. Assuming either the best or worst scenarios, what was your immediate reaction? How does this reaction make you feel?
5. Upon broad and careful reflection, how do you feel about how things have turned out?

As suggested by the ordering of these questions, the five response systems proposed by the ITPRA theory are engaged at different times during the daisy chain of anticipated and realized events. Imaginative reflection may begin months or years in advance, such as when an engaged couple consider marriage plans. As an anticipated event approaches, the feelings arising from the imagination are dominated

by feelings evoked by somatic and mental preparations — preparations that often take the form of tension or stress.

Once an event occurs (either anticipated or unanticipated), three post-outcome responses are initiated: (1) a response related solely to the accuracy of the prediction; (2) a quick reaction to either immediate dangers or short-lived opportunities; and (3) an all-inclusive reflective appraisal response. Similar to the imagination phase, appraisal-related emotions may recur from time to time — sometimes months or years later. We may re-experience feelings of regret appraising some long-past misfortune, or re-experience positive feelings appraising some long-past moment of good fortune. Also, we may change our appraisals over time, such as replacing a feeling of regret with relief — having learned, for example, that it was a good thing that one failed to secure employment with a firm that proved to be destined for bankruptcy.

In considering the different feeling states that can arise, it is noteworthy that some of the ITPRA response systems are more constrained than others. The prediction response is the most highly constrained, producing simple negative or positive feelings according to the accuracy of your prediction and the opportunity to update or improve a predictive model. The highest positive feelings arise when sensitivity to a novel context allows successful prediction in an otherwise unpredictable situation. The worst negative feelings are reserved for times when a seemingly obvious prediction proves wrong.

The reactive and tension responses are probably the next most constrained. In the case of tension responses, the evoked feelings are dictated by the range of possible postural, motor, visceral, and other corporeal states. By contrast, imaginative and appraisal responses encompass a huge range of possible feeling states, from compassion, pride, or humour, to jealousy, contempt, or loneliness (see Ben-Ze'ev, 2000).

By way of summary, in the flux of worldly events, expectation-related phenomena evoke a rich dynamically evolving mixture of feelings. Most of these feelings are short-lived and ephemeral. However, other feelings can arise long before an event occurs and can linger long afterwards.

The succession of these different phases in the expectation cycle is illustrated in Figure 1. It is this time-course that leads to the acronym ITPRA: Imagination-Tension-Prediction-Reaction-Appraisal.

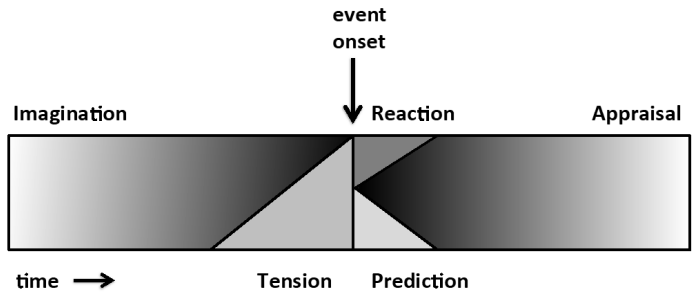

Figure 1. Graphic illustration of the ITPRA theory of expectation (from Huron, 2006). Imagining different future outcomes may occur long before an anticipated or unanticipated event (I). As an anticipated event approaches, mental and physical preparations produce distinctive feelings, often feelings of increasing tension (T). Following the event, positive or negative feelings are evoked simply in response to the accuracy of one's predictions (P). Simultaneously, a fast reaction response is activated whose purpose is to circumvent possible dangers or take advantage of important short-lived opportunities (R). Finally, feeling states are evoked that represent a more leisurely and inclusive appraisal of the outcome (A).

9. The Fast Action TPR Model

Notice that the *imagination* and *appraisal* responses are slow compared with the rapid *tension*, *prediction*, and *reaction* responses. Thought or contemplation requires time. Consequently, the capacity of individuals to engage in imaginative and appraisal responses depends to a large degree on the speed with which events unfold in time. When watching a fast-paced action film, for example, the observer may have little time to imaginatively engage in contemplating different future scenarios or to assess the repercussions of current events. Imaginative responses may be limited to rather broad brush-strokes, such as contemplating questions like: will the protagonist choose this or that course of action? Is this film headed for a happy or tragic ending? Appraisal responses may similarly be limited: although this scene seems to have had a bad outcome, perhaps it is ultimately beneficial.

In general, much of a film-viewer's experience will be limited to stream-of-consciousness responses. That is, the principal feelings arising from the film experience will be limited to the tension, prediction, and reaction (TPR) responses with little conscious engagement (Radman, 2017). Slower-paced films offer more opportunities for cognitive reflection. And compared with film, literature offers better opportunities to engage both imagination and appraisal

responses. Indeed, a reader may stop reading in order to contemplate a situation, both appraising current states and entertaining prospective thoughts (and the associated feelings) of possible future plot scenarios.

Music is similar to action films in so far as the succession of individual notes and chords may proceed at a blistering pace. Consequently, listeners have little opportunity to engage in (conscious) imaginative projecting ahead to contemplate different future musical directions; similarly, the speed of events constrains the opportunities for System 2 appraisals. Research suggests that the most common conscious phenomenon associated with music listening is daydreaming. In contrast to narrative arts like film or literature, music listening is much less likely to invite conscious imaginative thought regarding what might happen next. Nor does music invite much retrospective appraisal of individual notes, gestures, or passages. In short, music listening tends to leave the conscious mind alone, thereby offering greater scope for mental meandering. Consequently, most of the expectation-related feelings evoked by music reside in the TPR components of ITPRA.

10. Conclusion

Although originally motivated by the aim of accounting for various music-related phenomena, the ITPRA theory was intentionally developed so as to address the broadest range of expectation-related phenomena. Indeed, the theory has been cited in studies as diverse as marketing, dance choreography, videogames, jokes, eating disorders, public service announcements, and storytelling (Jensen, 2010; van Heeswijk, 2010; Hurley, Dennett and Adams, 2011; van Henten, 2012; Barker, 2012; Lyons and Mundy-Taylor, 2012). Nevertheless, the vast majority of research citing the ITPRA theory relates to research on musical expectation, with notable citations in the realm of film and film music (e.g. Lehman, 2013; Ireland, 2018; Pilewski, 2018).

Of course, the ITPRA theory is not intended to address all aspects of expectation, anticipation, prediction, or forecasting. The main aim of the ITPRA theory has been to account for the distinctive phenomenological experiences associated with expectation-related phenomena. In particular, the theory is intended to clarify and account for the sometimes baffling mixture of subjective feeling states associated with anticipation and surprise. It should be acknowledged that this article does not include any discussion of how expectations are acquired,

how they are mentally represented, and how they are shaped by different contexts. In the case of music, these questions are addressed at length in Huron (2006).

Finally, it should be noted that the ITPRA theory invites future theoretical refinement. As currently formulated, the theory offers little guidance regarding how to operationalize the components in order to permit the sorts of concrete predictions needed for experimental research. That is, the theory amounts to a post-hoc framework for interpreting observed affects rather than a computable model for predicting those affects. In addition, the physiological status of the five hypothetical response systems has not been explored. It remains to be seen whether the proposed response systems correlate in any way with brain organization.

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