

Sensorimotor Projection, Violations of Continuity, and Emotion in the Experience of Film

PATRICK COLM HOGAN

Abstract: Our emotional responses are determined not only by actual experience, but also by anticipation. Indeed, we respond not only to anticipations per se, but to the relation between anticipations and experiences. Such anticipations operate on different time scales, linked with distinct neurological substrates. Some—such as those involving expectations about the immediate trajectory of objects—are very brief. The relations between experience and very short-term expectations can have significant emotional consequences. One purpose of the standard continuity editing system is to avoid disruptions in our short-term projections. However, the manipulation of discontinuities, thus the controlled disruption of short-term anticipations, can significantly contribute to the emotional impact of film. It is possible to isolate distinct varieties of anticipation and disruption, examining their emotional consequences in different cases. Muzaffar Ali's *Umrao Jaan* provides a virtual catalogue of such disruptions and their emotional effects.

Keywords: anticipation, cognitive neuroscience, continuity editing, emotion, Muzaffar Ali, perception, *Umrao Jaan*

Appraisal theory constitutes the dominant cognitive approach to emotion. There are various sorts of appraisal theory. In general, they share a view of emotion as the result of judgments bearing on one's current progress toward the achievement of goals. More precisely, we may distinguish different components of an emotion event: eliciting conditions (what gives rise to an emotion), actional outcomes (what an emotion leads us to do in order to affect the eliciting conditions), expressive and physiological outcomes (how we manifest the emotion in our bodies through, for example, cries or changes in heart rate), phenomenological tone (how the emotion feels), and so on. Appraisal theories set out to explain eliciting conditions in terms of the relation between current

conditions and one's aims. One's judgment—or appraisal—of that relation defines one's emotion.

In *Cognitive Science, Literature, and the Arts* (Hogan 2003), I argued that appraisal theories have difficulty accounting for certain important data. Specifically, even in very simple emotions, our feelings and responses—for example, our actional and expressive/physiological outcomes—are often quite out of keeping with our judgments. For example, people who are afraid of flying may know perfectly well that airplanes are far safer than cars. Thus, they may appraise their likelihood of harm from a car accident as far higher than their likelihood of harm from an airplane crash. Put differently, they may fully recognize that their chances of harm increase far more when entering a car than when entering a plane. However, this appraisal does not affect their emotional responses with respect to cars and airplanes (i.e., their physiological outcomes of perspiration and increased heart rate, both far greater in airplanes than cars; their actional outcomes of avoiding planes or taking pills before boarding, etc.). At least *prima facie*, this discrepancy causes a problem for appraisal theories.

In response to problems of this sort I drew on neuropsychological research by LeDoux, Damasio, and others to argue that emotion is not a matter of appraisal *per se*, but the result of subcortical arousal. Such arousal occurs initially through the perception of innately specified environmental and somatic features. In addition, from the moment we first experience emotions, we begin to store implicit emotional memories. Any current experience that triggers an emotional memory will also lead to emotional arousal. Finally, arousal occurs due to imagined experience. Concrete perceptual imagination involves the same brain areas as perception (see Kosslyn 1994: 295, 301, 325; and Rubin 1995: 41–46, 57–59). When such imagination involves innate perceptual triggers of emotion or activates emotional memories, it produces emotion.

This subcortical activation model appears to be quite successful in explaining some intuitively primitive emotions, such as fear. However, it does not appear to be so successful in treating other, more apparently evolved or advanced, emotions such as grief. To a great extent, the problem here concerns the nature of emotion triggers. Emotion triggers appear to be positive presences, while grief results from absence.

More precisely, we tend to think of innate emotion triggers as singular and immediate. But emotion triggers may involve complex comparisons. Even fear triggers include implicit calculations regarding speed and direction of movement (on these calculations, see van Leeuwen 1998: 272). Bared fangs may be a trigger for fear, but so is swift approach—and our calculation of the latter is clearly the result of comparison. Moreover, we do not only compare two accomplished facts, but also facts and anticipations. The lion is barreling toward me. I freeze in anticipation of its attack. But, when it turns to pursue a gazelle,

I feel relief. The relief results from the contrast between the expected and the actual trajectory of the lion.

Anticipations are particularly crucial for one important parameter in emotional intensity—the gradient of change from one emotion to another. The sharper that gradient, the stronger the resulting emotion. A neutral event following happy anticipation leaves us sad, while the same neutral event following sorrowful anticipation leaves us happy.

In the following pages, I wish to explore one aspect of the relations among expectation, emotion, and film. Specifically, I will first distinguish different sorts of expectation. I will then enumerate the main functions of motor and perceptual, or more briefly sensorimotor expectation. I will then consider the relation of sensorimotor expectation to continuity editing. Finally, I will address the emotional effects of different types of continuity violation, focusing in particular on *Umrao Jaan*—the 1981 Indian film, directed by Muzaffar Ali.

Varieties of Expectation

We may distinguish three levels of expectation. The first is *situational prototyping*. We tend to organize experiences and actions by reference to prototypes. These prototypes give us broad outlines of how sequences of events are likely to unfold in certain identifiable circumstances. For example, situational prototyping governs our expectations of what will happen when we go to a restaurant. The prototypes are stored in long-term semantic memory and are activated—though not typically made the object of attentional focus—in the course of relevant plans and experiences. In some cases, they are combined with salient instances (e.g., a particular past visit to a particular restaurant) activated from episodic memory. Activation of prototypical event scenarios for a current situation (e.g., eating at a restaurant) commonly unfolds over tens of seconds or even minutes and, through re-activation, may bear on still longer periods. Expectations of this sort appear to be centrally a matter of corticocortical connections.

Situational prototyping applies not only to such banal expectations as those involved in eating at a restaurant. For example, the prototypes discussed by followers of John Bowlby—prototypes bearing on early infant/caregiver attachment patterns—probably fit here. Schore explains, “early-forming internal working models of the attachment relationship are processed and stored in implicit-procedural memory systems in the right cortex” (2000: 32). He quotes Rutter, “children derive a set of expectations about their own relationship capacities and about other people’s” responses “to their social overtures and interactions, these expectations being created on the basis of their early parent-child attachments” (Rutter 1987: 449; Schore 2000: 32). He continues, “Such representations are processed by the orbitofrontal system, which is known to be activated during ‘breaches of expectation’” (Schore

2000: 32, citing Nobre, Coull, Frith, and Mesulam 1999). In short, certain frontal systems of the human brain are linked with prototype-based expectations of just how other people (e.g., one's spouse) will respond to one's needs, interests, and so forth.

The second level of expectation is *working anticipation*. This is much shorter-term and operates through our moment-to-moment understanding of events and imagination of responses to those events in working memory. It results from the integration of prototypes (and episodic memories) with ongoing, particular experiences. Spontaneous short-term inferential particularizations of prototypical scenarios, inflected by episodic memories and changing current information (e.g., anticipating a question from the hostess as she approaches with menus), unfold over seconds. In part, this is bound up with the two-second capacity of working memory. (On the capacity of working memory, see Gathercole 1997: 20.) But it may also involve subcortical regulation of periodicity, particularly through connections between the cortex and the basal ganglia.¹

Finally, there are *sensorimotor projections*. As Robert Jourdain explains, "the brain perceives by anticipation . . . imagery arises from the unfolding of such anticipatory schemes in the absence of actual perceived objects" (2002: 163). Moreover, "the brain makes the body move not merely by shouting commands down the corridors of the nervous system, but also by anticipating the sensations that will result from those commands. We project a flux of such anticipations before us in whatever we do, testing them against incoming sensation" (ibid., 302). As to the connection between sensory experience and action here, Ivry notes that there is "a common timing system . . . in motor and perceptual timing tasks" (1997: 561). These projections involve very short-term expectations that are, for the most part, unself-conscious. For example, in the case of motor projections, research suggests that there is a period of 0.5 to 0.7 seconds after the motion is projected, but before the action is performed. After 0.3 to 0.5 seconds that motion may be inhibited (see Walter 2001: 248–250 and citations).

Sensorimotor projection is largely a matter of subroutines within working anticipations (e.g., unself-consciously looking toward the likely location of a constituent object, such as the hostess' hand, or an anticipated event, such as a gesture pointing toward one's table). The activation of subroutines for current working anticipations unfolds in less than one second and is almost certainly involved with corticocerebellar interconnections. The timing function of the cerebellum has been widely investigated. Ivry treats the operation of the cerebellum in "perceptual tasks that require the precise representation of temporal information" (1997: 555); "[f]or example, in order to generate an appropriate saccade, it is necessary to have an accurate representation of the future position of a moving stimulus" (ibid., 563). Akshoomoff and colleagues

state, “the cerebellum is a master computational system that anticipates and adjusts responsiveness in a variety of brain systems (e.g., sensory, attention, memory, language, affect) to efficiently achieve goals” (1997: 575). The cerebellum “is in a position to enhance neural responsiveness in advance of stimulation” (ibid., 577) and “plays an important role in tasks requiring anticipating rapid, continuous information” (ibid., 584). As “sequences of external and internal events unfold, they elicit a readout of the full sequence in advance of the real-time events. This readout is sent to and alters, in advance, the state of each motor, sensory, autonomic, attentional, memory, or affective system which . . . will soon be actively involved in the current real-time events. So, in contrast to conscious, longer time-scale anticipatory processes mediated by cerebral systems, output of the cerebellum provides moment-to-moment, unconscious, very short time-scale, anticipatory information” (ibid., 593). (See also Daum and Ackermann 1997: 461–462.) In short, the cerebellum appears to be particularly crucial for very rapid sequences of expectation.

Expectations are, of course, important for appraisal theorists. However, appraisal theorists tend to emphasize longer-term expectations, the larger careers of human projects and their fulfillment or disappointment—for example, the broad goal of remaining unharmed. In contrast, in my view, sensorimotor projections are most crucial. They are more directly involved with emotional experience in that, being more perceptually concrete, they are more directly connected with emotion triggers. By this account, then, sensorimotor projections (perhaps particularly as integrated into working anticipations) produce the emotion spikes that, as Greg Smith (2003, 1999) has argued, appear to be the generative components of emotion episodes. My very short-term expectation in opening a pantry door is a glimpse of, say, chocolate cookies. Instead, I see a sharp blade and a face. My sensorimotor projection is of immobility (cookies do not leap out at me). Instead, I glimpse motion—and, indeed, directed motion, with a trajectory toward me, yielding a short-term sensorimotor projection of physical contact. These very concrete perceptions and associated expectations are exactly the sorts of things that are likely to be innate triggers of emotion. For example, highly proximate motion directed toward my face is a clear trigger for being startled. In the context of other triggers, that startle response becomes fright, then fear (as it is associated with memories, ongoing working anticipations that include elaborations of sensorimotor projections, the experience of one’s own actional and physiological outcomes with their sensorimotor projections, and so on).

It is important to note that this conclusion is at least consistent with what we know about the neural substrate. Bauman and colleagues explain, “Studies in animals have demonstrated the existence of a direct pathway between the fastigial nucleus and the amygdala and septal nuclei, and a reciprocal circuitry between this nucleus and the hippocampus, suggesting that the cere-

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bellum may play a role in the regulation of emotion” (1997: 381; they also stress that the cerebellum is involved in “the ability to predict when an event should occur” and in “anticipatory planning” [ibid.]). (See also Parsons and Fox 1997: 265.) The crucial point for our purposes is that anticipatory effects are not isolated from emotion systems and their components, such as the amygdala, which is crucial to, for example, fear.

Indeed, I would argue that sensorimotor projections—most often, as integrated into working anticipations—are what give rise to emotion even in longer-term imaginations. This fits with Thach’s view that “The cerebellum plays the same specific role in . . . imagined movements that it does in actual movements” (1997: 608). Hallett and Grafman (1997) appear to contend that longer-scale expectations are governed by the cerebellum as well. For example, they ask, “Could it be that this same computational timing process is also done to anticipate the sequential position of cognitive events to be perceived or expressed in the course of strategic implementation or the expression of a ‘script’ or ‘schema,’” such as “eating at a restaurant” (ibid., 317). However, I believe that Hallett and Grafman have, rather, isolated the short-term, cerebellar component in longer-term projections. This fits with their emphasis on “the course of strategic implementation,” which necessarily involves a sequence of short-term, contextually changing expectations. In connection with this, it is perhaps worth pointing out that Hallett and Grafman give the cerebellum a timing function in the execution of processes in the prefrontal cortex (ibid., 318).

The emotional effects of sensorimotor projections (and working anticipations) bear not only on one’s own sensations and actions. They bear also on one’s sense of other people’s experiences. Specifically, there are two broad types of sensorimotor projections. Projections of the first type are egocentric—one’s own anticipated perceptions or actions, including anticipations that arise in egocentric imagination. Projections of the second type do not involve one’s own experiences and actions, but those of other people. As is well known, our brains respond to the actions of people we are observing as if we were engaging in those actions ourselves (see, for example, Brothers [1997: 78] on mirror neurons). We also commonly anticipate other people’s perceptions. We may refer to the expectations associated with their perceptions and actions as *mirror projections*. Mirror projections are of obvious relevance to the study of cinema.

Sensorimotor Projection and Film Technique

Sensorimotor projection evolved in such a way as to, in effect, mimic scientific principles of inference. However, projection does not strictly follow such principles. Rather, it comprises a set of mechanisms that commonly produce the same results as inferential principles in the environment of evolutionary adap-

tation. Functionally, these mechanisms are equivalent to a set of heuristic assumptions about the world.

We can think of these assumptions as a matter of constancy,² as follows:

1) We assume constancy in object properties (e.g., shape);

2) We assume constancy in object position;³

3) We assume constancy in our own perspective;

4) We assume constancy in the medium of perception. In practice, this is a matter of projecting constancy in light (source, direction, intensity, and so forth);

5) We assume constancy across sensory modes. Equivalently, we project coordination of sensory modes. When I smell smoke I project seeing smoke. Anderson makes a related point, from a somewhat different angle, when he refers to “cross-modal confirmation” in which “the information carried by sound and image is perceived as being generated by a single event” (1996: 87, 86);

6) When there is not constancy in properties, position, perspective, or perceptual medium, we project a constant trajectory of change;

7) Finally, when change does not follow a constant trajectory, we assume that it follows a recurring pattern. Consider music. I hear some melody for the first time. The pitch and duration of the sound change and they do not change in a uniform trajectory (as they would in, say, a whole tone scale). However, after I have heard the melody, I come to expect its repetition, perceptually projecting notes before they are played (thus experiencing surprise at variations). The same point holds for melodies that I heard in the past and recall when I hear the opening notes.

All of these mechanisms have a significant impact on our experience of film. One could understand continuity editing as a system designed to minimize disruptions of the perceptual projections indicated above. At the same time, a wide range of film techniques produces such disruptions, generally toward emotional or thematic ends. Before examining these functions, I would like to isolate some main types of disruption—specifically, the main types of disruption that move toward discontinuity. (Disruption may involve excessive continuity as well as excessive discontinuity. The most obvious technique that violates our projections toward excessive continuity is the graphic match. To make this discussion more manageable, I will consider only cases of excessive discontinuity.)

The most common cases of (discontinuity-producing) disruption in continuity expectations concern motion, that is assumptions about continuity in change of position. Discontinuity in our projection of motion can go in one of two obvious directions. It can impede the trajectory suddenly in an unprojectable way (i.e., in a way we could not have projected beforehand) or it can advance the trajectory suddenly in an unprojectable way. These techniques

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appear in their most extreme forms as freeze frames and jump cuts—more precisely, what we might call *jump cuts on action*.⁴

A rarer, and more disturbing sort of discontinuity concerns perspective. We experience a discontinuity in perspective most obviously when we feel lost or disoriented. In cases of this sort, something seems to have gone awry, not with the properties or position of objects, but with our projection of our own position relative to the rest of the world. This seems to be involved in the difference between “an egocentric navigational control system, under cerebellar and basal ganglia control, opposed to the well-known allocentric spatial relation system, under hippocampal and neocortical control” (Molinari et al. 1997: 227; see also Daum and Ackermann 1997: 466). Discontinuity in our sense of perspective is also produced by jump cuts, specifically, what we might call *jump cuts on perspective*.

Instances of both discontinuities can be found in *Umrao Jaan*.⁵ Muzaffar Ali makes some use of jump cuts on action. For example, in a dancing scene,

Figure 1. Jump cut on action: first dance gesture.



Figure 2. Jump cut on action: second dance gesture, which follows from the first without any transition.



Figure 3. Freeze frame.



Ali strikingly deletes parts of Umrao's movements and gestures as a dancer (see Figures 1 and 2). He also disrupts motion in the opposite direction, but only once. Specifically, the film ends with a freeze frame. Umrao walks up to a mirror that is covered with dust. She brushes a patch clean. As her hand passes over the mirror, we see her face in the dusted arc. Ali freezes her in mid-motion (see Figure 3). The disruptive effect is enhanced by Ali's earlier use of jump cuts on action. These make motion faster and more erratic than our perceptual projections. This halting of the trajectory, then, is not in keeping with our default projections or with any alternative expectations we may have derived from the film.

Ali also makes a striking use of jump cuts on perspective. For instance, at one point we have a shot of young Umrao and the other women of the brothel in conversation. There is a cut and we

have the same arrangement of figures, but we are slightly to the left and slightly closer, as if the camera has dollyed to that position, but the movement has been deleted (see Figures 4 and 5).⁶

Umrao Jaan shows examples of several other kinds of perceptual disruptions concerning the coordination of sensory modes, lighting, object properties, and patterns. We experience a violation in the coordination of sensory modes when there should be a direct causal connection between the visuals and the sound, but there is not. We find this in conflicting sound/image montage. A fine case occurs when *Umrao* is performing in the town from which she was kidnapped as a girl. In the middle of the performance, she walks offstage and proceeds to her family home. Her lips are not moving, but her song continues.

It is obvious that films frequently violate our expectations with respect to lighting. For the most part, those violations are, first of all, a matter of situational prototyping. However, discontinuities of perceptual projection do occur. As far as I know, there is no term for this sort of discontinuity. We might term it a *jump cut on lighting*. Ali has taken this up as well. For example, in the scene just mentioned, he repeatedly cuts from shots in which the background is lit to shots in which it is unlit—even when we seem to maintain the same perspective on *Umrao* (see Figures 6 and 7).

Disruptions of our projections based on object properties do not seem to be very common in film. When they do occur, they tend to lead toward the isolation of patterns of change, as when our hero begins to metamorphose into a



Figure 4. *Jump cut on perspective: first perspective.*



Figure 5. *Jump cut on perspective: second perspective, which follows from the first with no transition.*



Figure 6. *Jump cut on lighting: Umrao dances with a lighted background.*

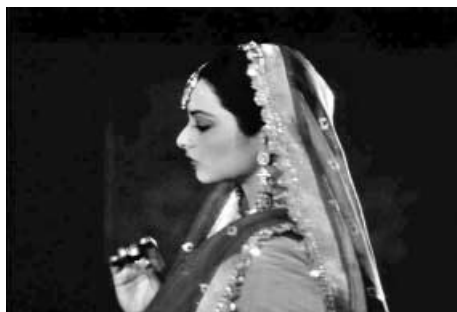


Figure 7. *Jump cut on lighting: Umrao turns and, following a cut, the background is dark, though the continuity of the motion suggests that no time has passed.*

Figure 8. Disruption of projections of object properties: Umrao with tears rolling down her face.



Figure 9. Disruption of projections of object properties: Umrao continues her dance without a pause, but the tears are gone (and the lighting has changed).



Figure 10. Disruption of projections based on patterning: canonical shot of shot/reverse shot sequence.



Figure 11. Disruption of projections based on patterning: dissymmetrical reverse shot.



werewolf. There is a disruption of perceptual projections relating to object properties here. But it is quickly stabilized by perceptual projections of a certain sort of patterned change. More fundamental and disorienting disruptions are, however, possible. We most often associate these with the use of trick photography. Ali takes up object discontinuity in a less obtrusive, and for that reason more intriguing way. We might refer to this as a *jump cut on properties*. We find a remarkable case of such discontinuity during Umrao's final dance. Umrao begins to weep as she sings. In one close-up, tears are rolling down her

cheeks. Ali cuts to a second shot, continuous with the first in Umrao's location and gestures, but now the tears are missing (see Figures 8 and 9).

Finally, there are disruptions in our projection of patterns. Projections in these cases are not so narrowly pre-wired in our neuro-cognitive make-up. Rather, they derive from current or past experience. In these cases, then, discontinuities may rely on our familiarity with continuity editing. Consider, for

example, canonical shot/reverse shot sequences in a dialogue. The first character speaks. We see him or her from roughly over the shoulder of the second character. When the second character speaks, we cut to the parallel position from the other side. Ali repeatedly violates this pattern. First, he often pays no attention to who is speaking when he cuts from one character to the other. Second, he often avoids parallel shots. For example, in one dialogue, he shoots Umrao's lover in the standard format. However, when he cuts to Umrao, he uses a tight close-up (see Figures 10 and 11).

Ali's film clearly contains a wide range of violations of the continuity system and our associated sensorimotor projections. Needless to say, it is not alone in this. But what effects do those violations have, particularly with respect to the viewers' emotions?

Perceptual Discontinuity and Emotion

It has often been suggested that techniques of discontinuity, such as jump cuts, disturb our assumption of the reality of the events in the film. One suggestion of such a view is that these techniques will lead us to think critically about the film rather than respond emotionally to it.⁷ Yet anyone who has seen *Umrao Jaan* could not help but notice that these techniques enhance our emotional response. In conclusion, I would like to sketch a few of the ways in which this occurs.

The simplest or most basic emotional effect is the intensification of interest—a crucial part of our emotional response to film, as Ed Tan (1996) has stressed. The generation of interest is a minimal emotional consequence of discontinuity editing that results in the disruption of perceptual projection. Frijda explains, “Any stimulus change elicits the orienting response; this includes omission of an expected stimulus” (1986: 272 [see also 325]; as LeDoux puts it, “In the presence of novel . . . stimuli the axon terminals release neurotransmitters and ‘arouse’ cortical cells, making them especially receptive to incoming signals” [1996: 289]). The orientation response is a sort of pre-emotional response of increased perceptual awareness, including increased sensitivity to emotion triggers.⁸ It may enhance our reflection on a work. Indeed, the violation of expectation does generally lead us to seek causes. Kahneman and Miller explain that we pose “a why question” in cases where “a particular event is surprising,” cases where we experience “a contrast between an observation and a more normal alternative” (1986: 148; see also Frijda 1986: 272–273, 318, and 386). Indeed, in the case of *Umrao Jaan*, Ali certainly intends to stimulate reflection on political topics—such as the treatment of women in India, the role of religion in exploitation, the place of British colonialism in social relations—and on concerns that are simultaneously personal and mystical, such as the nature of human relations and the possibility of sustained love. The disruptions are inseparable from the film's themes—political, personal, or mystical and religious (specifically Sufi). However, the orientation response does not enhance reflection by distancing us from the emotional impact of the work, whether that emotion is one of empathic sorrow, empathic fear, empathic love, or something else. Quite the contrary, part of our orientation is an orientation toward emotion.

More important, there are ways in which the disruption of perceptual projection can produce emotional effects far more powerful than the arousal of interest. Perhaps the most obvious is altering the gradient of emotional change

with respect to expectation. Take the case of the dissymmetrical shot/reverse shot (see Figures 10 and 11). We perceptually project seeing Umrao from a certain distance. Had we seen her from that distance, we would have shared her sorrow in this scene for the usual reasons (for example, those discussed by Plantinga [1999] in his essay on emotional response to the human face). The unexpected shift to a tight close-up serves to enhance that feeling. Again, a sharp gradient of emotional change from expectation can affect the intensity of our emotional response. Here, we have a sharp, sudden change from perceptually projected distance to greater proximity. The proximity of an emotion trigger (here, an emotionally expressive face) is almost always an intensifier of the relevant emotion. Thus the effect of disrupting our perceptual projection, in this case, is the intensification of our empathic response.

The jump cut on perspective is often connected with the violation of proximity projection—specifically in cases where we feel that *our* position has changed, rather than that of the object. The most obvious use of this technique is in creating a sense of disorientation. In *Umrao Jaan*, disorientation effects are very limited, and thus primarily a matter of intensifying interest and attentional focus. If repeated or developed in such a way as to inhibit reorientation, disorientation might be used to heighten anxiety in particular. However, jump cuts on perspective may also be used to disrupt proximity projections in ways that are not seriously disorienting. As such, they may be used to intensify virtually any emotion. Perhaps most interesting is the non-disorienting violation of perspectival proximity projections that seem to be unusually effective in triggering a sense of wonder. For example, when Ali violates shot/reverse shot projections, he simultaneously disrupts our projected perspective on Umrao. Specifically, the disruption gives a sense that we are suddenly much closer to Umrao. Along with my empathic sorrow for Umrao, I experience an almost breath-taking delight as well. This is clearly a function of the gradient of change in proximity, as well as the emotion-triggering properties of the actress's face and expression. But it is also related to the fact that I feel that I have approached her, rather than her approaching me, to advert to Per Persson's useful distinction (2003).

In addition to proximity, there are two other obvious ways in which emotion triggers may be manipulated to intensify emotional effects—by increasing their frequency or by extending their duration. Both forms of manipulation are found in the disruption of perceptual projection through discontinuity editing. For example, the gestures of Indian dance are emotion triggers for those familiar with Indian dance. However, the movements used in passing from one gesture to another probably do not have emotional consequences. Jump cuts may serve to increase the density of the gestures, thus their emotional impact. This is precisely what we find in *Umrao Jaan* when Ali cuts from gesture to gesture, largely discarding the intervening movements (see Figures

1 and 2). This cutting clusters emotion triggers in a briefer span of time than we would project.

Conversely, the prolongation of an emotion trigger may serve to extend its effects beyond the brief period when we expect it to continue. Ali's use of the freeze frame at the end of the film has this effect (see Figure 3). Indeed, the effect is enhanced as we continue to project the dissolution of the image, while simultaneously encoding more of the emotion-triggering information. Though it is difficult to establish the point, my own experience suggests that the image does fade at about the time I stop perceptually projecting its disappearance. This, then, produces its own emotional effect.

Disruptions in object continuity are perhaps more likely to produce emotional effects through the gradient of emotional change in connection with the shortening (rather than prolonging) of emotion triggers. Consider, again, the cut from Umrao with tear-stained cheeks to Umrao with a dry face (Figures 8 and 9). We perceptually project the prolongation of the weeping, the continuation of the tears. The disruption of our projection diminishes the (sorrowful) effect of the emotion trigger by shortening its duration. In addition, the shift to a dry face creates an emotional gradient from sad to neutral, producing a positive emotion. The effect is enhanced by the change in lighting. Ali begins with the background in darkness—darkness being an emotion trigger for anxiety. We perceptually project the continuation of the darkness. The slight, but perceptible increase in light shortens the duration of the initial emotion trigger and creates a gradient of change from apprehensive to neutral, thus again producing a positive feeling.

Finally, the dissociation of sensory modes seems to have two main emotional effects. First, such dissociation may be used to imitate a pathological breakdown of sensory binding (i.e., a pathological separation of our ordinarily coordinated experiences of hearing, seeing, feeling, and so on). This produces a form of disorientation. Its likely consequence is anxiety. However, this is not how Ali uses the technique. In the case mentioned above—where Umrao walks offstage and stops moving her lips, but the song continues—Ali makes a specific division between proprioception (Umrao's experience of walking toward her parental home) and external perception (the continuing song). Umrao apparently experiences herself—and we experience her—as walking toward her home while hearing her own song as if it came from someone else. This division serves to mimic, not pathology, but rather an ordinary type of experience. That experience occurs most obviously when emotional engagement with a single object or action deprives everything else of emotional value and thus of attentional focus. To give an example: I am playing a familiar piece at the piano. I see someone enter the room. I think I recognize her as a famous Bollywood actress, but I am not sure. I follow her with my head, turning my body as she crosses the room. As this is going on, the music con-

tinues, a sort of background to what I am doing. It continues because I have continued playing. But I do not recall playing. I did not experience playing the piano, although I was doing it. Such intense and exclusive object- or task-orientation most obviously occurs when we experience a powerful emotion and a pressing opportunity that bears on that emotion. In Umrao's case, the emotion is a form of attachment anxiety and perhaps the opportunity is a unique chance to go home. We commonly refer to our feeling in such circumstances as "absorption" or "distraction." Our response to Umrao's absorption and the related dissociation of sensory modes is complex. It presumably combines an empathic mimicry of the character with emotional memories related to perceptual dissociation.

Throughout the movie Ali violates our short-term expectations repeatedly toward emotional ends. In some cases, these violations involve situational prototyping, and of course they occur in a narrative that itself involves long-term goals. However, it seems that, as emotion triggers, they rely most importantly on our sensorimotor projections, often integrated with working anticipation.

In sum, our emotional experience of the world is inseparable from expectation. Contrary to the assumptions of appraisal theorists, the most crucial forms may be very short-term expectations—sensorimotor projections and working anticipations that incorporate such projections. Again, sensorimotor projections are the most concrete, thus the most likely to recapitulate innate emotion triggers and the most likely to activate emotional memories. These projections approximate a set of assumptions about constancy in object, location, perspective, medium, sensory coordination, trajectory of change, and pattern of change. The practices of continuity editing are, to a great extent, designed to prevent disruption of perceptual projection. However, filmmakers often violate these practices, disrupting perceptual projection. Contrary to the suggestions of some film theories, such disruptions need not produce an alienation effect. Rather, they often have quite powerful emotional consequences. Moreover, they have these consequences for cognitively specifiable reasons. These include the increase in gradients of change from emotional expectation to experience, often through violations of projected proximity; the clustering, prolongation, or limitation of emotion triggers; and the activation of emotional memories associated with such complex states as emotional absorption, itself signaled in part by the dissociation of sensory modes. Clearly, this analysis is only preliminary. (The development of empathic absorption—and even the algorithmic specification of processes that produce absorption initially—particularly call out for more developed treatment.) However, I believe it suggests potentially valuable areas of research on emotion and short-term expectation—research that should centrally involve not only the usual

laboratory studies conducted by cognitive neuroscientists, but also the study of our ordinary experience of audiovisual media.

Patrick Colm Hogan is a professor in the Department of English and Program in Cognitive Science at the University of Connecticut. His recent books include *Colonialism and Cultural Identity* (2000), *The Mind and Its Stories: Narrative Universals and Human Emotion* (2003), *Cognitive Science, Literature, and the Arts: a Guide for Humanists* (2003), and the forthcoming *Understanding Indian Movies*.

Notes

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¹ On the relation of temporal calculations to the basal ganglia and the cerebellum, which appears more important for sensorimotor projection, see Ivry 2000.

² A number of authors have noted that “the ‘assumption’ of a stable and continuous world . . . is built into the visual system” (Anderson 1996: 94), though usually the observation is general, and inexplicit about the mechanism/function distinction.

³ The neurological distinction between processing the properties of an object and processing the location of an object is well established. The different processes are commonly referred to as the *what* and *where* pathways (see, for example, Ramachandran and Blakeslee 1998: 77).

⁴ Slow and fast motion may seem to fit here. However, they do not violate our assumption of constancy in change of position so much as our pattern-based expectations regarding certain sorts of motion—such as the speed at which people walk.

⁵ The story of *Umrao Jaan* is set in nineteenth-century India. It is about a young girl named Amiran (later renamed Umrao), who is kidnapped and sold to a brothel. She is trained as a singer and dancer, also developing into a fine poet. In a sense, her life is a series of losses in love, both romantic and familial. The losses relate to the thematic concerns of the film. Specifically, Umrao’s poetry is written in the tradition of Sufism, the mystical tradition of Islam. In this tradition, all earthly loves are inadequate approximations to divine love. In the monistic form of Sufism, divine love comes only in the recognition that all souls are the same in God. In the final shot of the film, Umrao, having lost all her earthly loves, faces herself in a mirror—a common symbol in Sufism that suggests the beginning of such recognition. For a brief introduction to Sufism, see chapter five in Waines’s *An Introduction to Islam* (1995). For a further discussion of the thematic concerns of the film, particularly in relation to its visual style, see chapter five in Hogan’s *Understanding Indian Movies* (forthcoming).

⁶ When one isolates and prints the frames, one sees that there is also a jump cut on action in this scene. But it is not really visible when one watches the film. It is well known that there are lower and upper limits on what we perceive as a jump. At the upper limit, we do not perceive a single discontinuous event. Rather, we segment our experience into two events (e.g., when we see someone picking up a hat, then walking out the door—as opposed to picking up the hat, then placing it on his head without the intervening motion of lifting his arm). The lower limit is the point beyond which we do not experience discontinuity in events that we do encode as singular—as with the jump cut on action in this sequence. This is in part related to the visual system’s compensation for eye blinks and other brief discontinuities in ordinary perception (see Anderson 1996: 91, referring to Gibson).

⁷ For example, Heath characterizes film as “potentially a veritable festival of affects” through “reproduction of life and the engagement of the spectator in the process of that reproduction as articulation of coherence” (1981: 53). This reproduction results from “a trap for the look” that produces “an *illusion of reality*” (ibid.: 70 n12). This is bound up with “Identification with the camera” and inseparable from “the smooth stability of the scenographic

vision" (ibid., 49). More exactly, "the rules of filmic construction of space on screen," specifically including the 30-degree rule (which prevents jump cuts), serve to "background the image flow into a unified subject-space, immediately and fully continuous" (ibid., 42). In this context, the primary function of continuity violations would appear to be the disruption of the illusion of reality and thus the disruption of the "festival of affects." In other words, its function would seem to be that of creating self-awareness that produces "a critical distance from one's . . . attitudes" (Hammett 1997: 246, speaking broadly of one strand in contemporary film theory). (See also Yau on Deleuze's taxonomy of cinema. Yau treats cinema that "foregrounds disturbance in the audience's act of seeing." This form of film practice is exemplified in "Godard's use of jump cut" [1998: 61].)

⁸ There are complications here, relating for example to the inability to make sense of the disruption which, when repeated, may give rise to boredom, thus the opposite of interest (see Hogan 2003: 8–14 and 23–25).

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