

The PECMA Flow: A General Model of Visual Aesthetics

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Several critical statements proposing that *general theory* – also known as *Grand Theory* – should be banned from the discipline of film studies have motivated me to discuss the validity of general theory within film studies. Nine years ago, I proposed a general theory of the film experience and the central dimensions of film aesthetics in my book *Moving Pictures*.¹ The central model of this book described the flow from perception, through emotional activation and cognitive processing, to motor action. Since then, I have named this model the *PECMA flow* (short for perception, emotion, cognition, and motor action). An additional feature of the PECMA flow model is the evaluation of reality-status, based on combining a radical constructivism with evolutionary realism. In this paper, I will attempt to show that a series of problems within film theory and film criticism – for example, the questions of excess, linear vs. non-linear forms, realism, and reality effects – have relatively simple explanations within a general theory of how the brain processes film.

I. General Theories or Middle-Level Theories?

In a recent review of *Moving Pictures*, Tico Romao claims that it is the wealth of smaller scale theories 'rather than the tenability of [Grodal's] principle thesis that makes *Moving Pictures* a rewarding read'.² Romao does not, however, point out any specific flaws in my principle thesis, except that it does not allow for describing film as a strongly culturalist-historical product. Further, Romao does not explain how a problematic thesis yields a wealth of rewarding

smaller scale theories; he just echoes the mantra that you should do middle-level research and concrete analysis.

Romao is not the only film scholar who dislikes general theory à la the PECMA flow model. Asbjørn Grønstad has criticised the approach put forward in *Moving Pictures* for being a psychological theory as opposed to a film-aesthetic theory,³ and Christer Mattson makes a similar point.⁴ Both Grønstad and Mattson cite David Bordwell⁵ – and implicitly Bordwell and Noël Carroll's *Post-Theory*⁶ – as an 'expert witness' for their criticism of neurocognitive film theory (and the flow model). They argue that general theory is reductionistic and irrelevant for understanding the specifics of film: film studies should be concerned with *middle-level* or *piecemeal theorizing* and close textual analysis (what the Russian formalists might have called the 'filmnost' approach). Ironically, both Grønstad and Mattson misuse Bordwell as an 'expert witness': both the final chapter in *Making Meaning*⁷ and the paper 'A Case for Cognitivism'⁸ explicitly argue against the view that film studies should be exclusively focused on those features specific to film. Likewise, Bordwell's *Post-Theory* article on functionalism in film style draws heavily on general theory.

It should be acknowledged that the arguments in *Post-Theory* for discrediting Grand Theory are sound and well-argued: Grand Theory, in the form of psychoanalytical semiotics, was a disaster zone and not a theory at all. Furthermore, Grand Theory made it easy for film scholars to pursue the disastrous separation of the humanities from the sciences; it made film scholars think that they had all the right answers,

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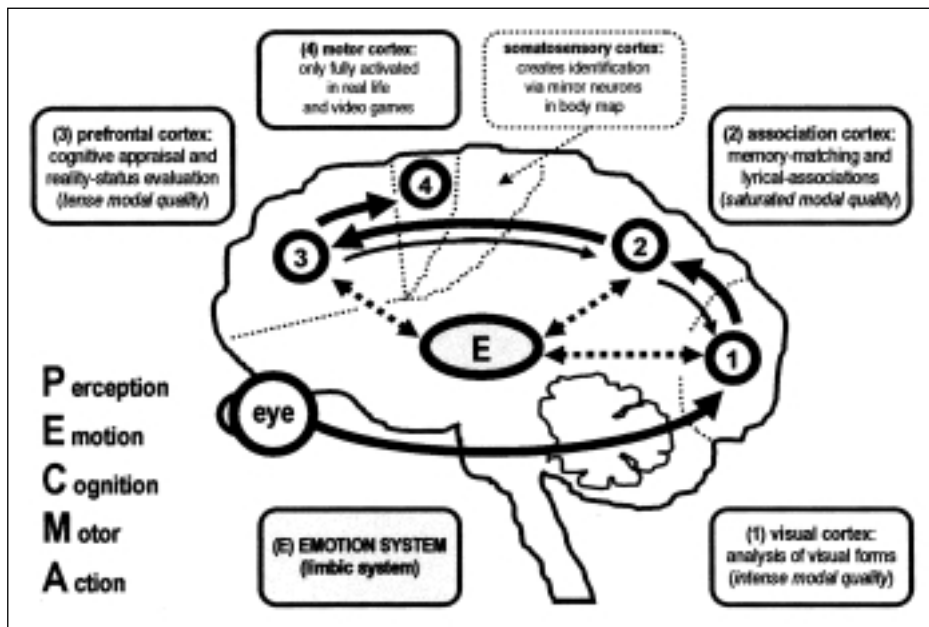
whereas the sciences (natural sciences, health sciences, and social sciences) were utterly wrong and immersed in western bourgeois ideology. Since they could not compete with science, they claimed that it was false or ideological. This strategy, pursued by the Frankfurt School and poststructuralism, is clearly the loser's strategy.

Despite these worthwhile objections to specific Grand Theories, the title and some of the content of *Post-Theory* are problematic when applied to all general theories. To claim that we should go beyond theory sounds more like postmodernism or poststructuralism than science. The fact that psychoanalytical semiotics failed as an example of Grand theory does not justify abandoning the types of general theory that have served science so well for centuries. An unfriendly interpretation of general theory is that it leads to logical positivism – the view that the world can be understood in terms of a sheer collection of empirical data plus some low level hypotheses. The big achievements of natural science, however, consist in combining empirical observations with general theories. Theories

proposed by Newton, Bohr, and Einstein are eminent examples.

One of the reasons general theory creates problems for film studies is that film studies is largely rooted in a specific and historical approach to the humanities that is quite uninterested in the ancient tradition, going back to Aristotle, of studying general features of the cultural products of the human mind. Those film scholars who strictly adhere to the historical-specificity version of the humanities hate generalizations and reductions and want to build a wall between humanities and the sciences so that they do not have to compete with all-powerful modern science. For instance, they may produce Lacanian just-so stories instead of using state-of-the-art psychological theories as the basis for film theory. But the effort of erecting trade barriers between the disciplines is vain and will only lead to decay. If you cannot beat science, rather than rejecting it, join science and produce film theories that are consistent with the aesthetic dimensions of modern psychology.

- Figure 1: The PECMA flow model.



II. The PECMA Flow Model

To the extent that it is possible to make general laws and general theories about the working of the human mind, it is also possible to make general theories of film aesthetics. And this is what I did when I proposed the first version of the PECMA flow model in *Moving Pictures*. This book used the flow model, and the notions of facilitating and blocking the flow, to sketch a new theory of narrative and lyrical genres. The properties of the flow model are based on the fundamental features of brain architecture. It should be stressed, however, that the model does not prevent middle-level or piecemeal research; on the contrary, it provides a *framework* for conducting middle-level, piecemeal investigations of specific film experiences. The model also helps film historians in the sense that it provides a better understanding of what aspects of films should be described historically and what aspects should be described psychologically. At the same time, the model enhances our understanding of how different parts of the film experience draw on different aspects of the human mind and thus require different micro-theories.

Let me repeat some of the key findings and further point out how some examples of piecemeal theory make problematic assumptions and fail to account for aesthetic features that are easily explained within the PECMA framework.

The basic assumption of semiotic film theory – and even the implicit assumption in some strands of cognitive and philosophical film theory – is that viewers are looking at moving film images, and that those images are seen initially as representations and then matched to a referent (a pro-filmic event, a meaning, etc.). In contrast, the PECMA flow model takes what I sometimes call a ‘direct drive’ approach. PECMA flow starts when light information enters the eyes. Whether this information is derived from the real world or from moving images does not make a fundamental difference for most of the brain systems connected to film viewing, although part of the brain is very much occupied with assessing the reality-status of what we see.

When watching a film, we do not primarily see *representations* of people and landscapes; we simply see people and landscapes, although we know that this seeing is induced by artificial means. Our knowledge that our seeing is artificially induced creates a conscious feeling that the objects are not real. This feeling can vary in strength depending on the film and the viewer.

When speaking of films and other aspects of reality, it is easy to forget that although the world outside our heads has an objective existence, we only have access to films or reality through our brains. Therefore, our experience of film exists side by side with our experience of real events; the film experience runs on the same brain circuits as those used for real world experience, and only mental ‘reality-status markers’ indicate the difference between visual fiction and online fact.

To understand the PECMA flow in detail requires some remarks on the general design of the embodied brain (see Figure 1). The basic architecture consists of the following:

1. Input devices. Sensory organs located on the periphery of the body (for example, the eyes and ears) transduce the information available in light and sound, and send this transduced information to internal brain systems (e.g., the visual cortex, located in the rear part of the brain) for further analysis.

2. Associative networks. Adjacent parts of the brain (for example, the association cortex) match the input in question with schematic representations of objects and events stored in memory.

3. Cognitive centres. The advanced cognitive capacities of humans can be attributed to the neocortical structures built on top of the evolutionarily older parts of the brain such as the limbic system; these capacities allow us to perform a more sophisticated analysis of the input, and to generate hypotheses and simulate consequences before the output (e.g., motor action) is produced. (Those mental mechanisms that support the canonical narrative are vital parts of this hypothesis-simulation activity and are developed to support how a person orients

themselves in space, assesses their preferences, and acts accordingly.)

4. Output devices. The motor system (located in the motor and pre-motor cortices) controls the actions performed by the muscles, whilst planning and simulating alternative motor acts. If the viewer cannot respond to the input in ways that put the world in accord with her preferences, then the limbic system may modify the body's internal states to produce crying, goose flesh, shivering, and laughing.

(E) Emotion centres. The limbic system (located in the centre of the brain above the brain stem) evaluates inputs from both the external world and the body, according to innate and acquired preferences. These evaluations initiate autonomic processes which modify the inner states of the body (through the emission of hormones and neurotransmitters), and motivate appropriate cognitions and actions. Although the general direction of the processing of the filmic input is from stages 1 to 3, and even the pre-motor part of stage 4 (in conjunction with muscular tension), it should be stressed that the emotion centres in the limbic system continuously interact with all mental processes: perceptual, associative, cognitive, and motor. In normal language, the word 'emotion' only describes a few high-order phenomena such as love and hate; however, emotions express the embodied brain's motivation system and affect even the most basic processes by which the brain tries to make sense out of the millions of pieces of light information that arrive through the eyes.

Films produce inputs that influence, highlight, or impede different stages of the PECMA flow; the filmic input plays with different neurocognitive mechanisms to elicit different types of effect, as I will explain in the following.

Stages 1 and 2: Perception and Association, Emotional Activation and Emotional Labelling

In the first stage of the process, visual information is transmitted from the eyes to the visual cortex. The enormous task of breaking down millions of pieces of visual information into identifiable forms and figures is performed by a

series of brain modules. In *Moving Pictures*, I suggested that this preliminary visual analysis works in tandem with the emotions and that the corresponding emotional experience has an *intense* modal quality. Such intensities are most noticeable in relation to abstract and simple forms. The function of the visual cortex is finding salient forms in the chaos of information that arrives through the eyes and the brain receives a small emotional reward every time it discovers a significant form. Symmetry, for instance, is highly salient because symmetry is typical of living organisms. Furthermore, since the perceptual system is programmed to reward the reduction of visual complexity to simpler forms important for motion and action, visual art may provide pleasure by salient simplicity.⁹ New research published after the release of *Moving Pictures* supports the connection between visual and emotion systems. Vilamur Ramachandran and William Hirstein, for example, have proposed some theories of how emotional activation cues visual analysis – and, as a byproduct, fuels aesthetic experience – thereby adding additional strength to my hypothesis.¹⁰ In addition, Claus Bundesen *et al.* have shown how the pulvinar part of the thalamus – part of the emotion-generating limbic system – is central for visual attention.¹¹

In the second stage of the PECMA flow, adjacent parts of the brain (for example, the association cortex) match the analysed forms with schematic representations of objects and events stored in memory. Each object and event is associatively connected with an emotional label or tag provided by the emotion system: for example, wolves are dangerous, apples are tasty, some types of people are friendly, and other types of people are hostile. When an object or event appears on the screen and is successfully matched to a memory, the mind is emotionally activated and action is motivated: avoid the wolf, approach the apple. In this way, perception sets the body and the brain into the appropriate response mode.¹²

If a film presents emotionally salient images outside of a classical narrative (a story with goal-oriented characters acting in a coherent space-

time), then the viewer perceives no actions or events that can release her emotional tension. In this case, the viewer will undergo what I have called a *saturated* emotional experience; that is, she will become 'saturated' with emotions. Music videos and art films without any fixed narrative may evoke fear, lust, hate, or sublime-oceanic feelings because these emotions are 'disembodied', cut off from an objective world in which a character's actions can release emotional tension. When a number of emotionally-charged objects are presented simultaneously and/or in sequence, the mind will build up a strongly charged network of associations and will attempt to find some common denominators for the associations. For instance, Andrej Tarkovskij's *The Mirror* (1974) presents salient images of fire, rain, wind, and characters in emotional states. Although the build-up of emotionally-charged associations has no clearly focused narrative meaning, such associations may produce an experience of perceptual, cognitive, and emotional plenitude and deep meaning because of the complexity and emotional charge of the mental associations involved.

Roland Barthes calls some kinds of salience 'third meaning', suggesting that what I call 'intensities' and 'saturations' have a deeper significance. The PECMA flow model suggests, however, that a meaningless perceptual and emotional salience can produce feelings of meaning. The brain is programmed to monitor and make sense of objects and events that demand action. As a consequence, artists and filmmakers are capable of producing perceptual inputs that hyper-activate the monitoring and sense-making circuits. Art films and comic, religious, and supernatural fictions can similarly activate meaning-making systems. These films prominently feature paradoxes, which can create an illusion of meaning because the mind's hermeneutic machinery is dedicated to noticing and unravelling riddles. In comparison with, say, a semiotic approach, the explanatory advantage of the PECMA framework for film analysis is that it enables us to understand that our film experiences are centrally embodied processes and are not based on the reading or decoding of

fixed signs and discrete meanings. In short, film not only provides propositional meanings but also a range of perceptual, cognitive, and emotional experiences cued by the playful activation of our embodied brains.

Stage 3: Cognition, Narrative, and Identification

In the case of canonical narrative films, the processing of the flow usually progresses to the third stage, where we cognitively assess the film in terms of its characters and events. Significantly, this process requires us to cognitively identify with a character, thereby adopting that character's goals and concerns. Central to this cognitive activity are those frontal areas of the brain – especially developed in humans – that appraise situations for their emotional significance and plan actions in accordance with emotion-based preferences.¹³ Given that our emotions are related to what Nico Frijda describes as 'action tendencies',¹⁴ our emotional experience is defined by a background muscular *tensity*. It is as if both the brain and the body project themselves into the external world of the film. First, the puma approaches, then fear is evoked, then the decision to fight or flee is made, then a gun is drawn or a safe place found, and so forth. (If the order of events is scrambled, then the emotions will become less tense and more saturated, as demonstrated by films such as *Last Year in Marienbad* [1961]. Even the slight scrambling of the narrative order caused by starting with the end of the story, as in many noir melodramas, will saturate the emotional experience.)

The PECMA flow model suggests that the fabula (the 'story') is not primarily the end-result of processing the *syuzhet* (the 'discourse'), contrary to the narrative theory proposed by David Bordwell in *Narration in the Fiction Film*.¹⁵ The classical division between story and discourse is a useful tool when describing narratives with a very scrambled temporal order, but it is not so useful when describing the canonical film that is linearly progressing in time. Furthermore, the story-discourse distinction is problematic as a description of the film experience because the

typical experience does not entail thinking that the film is a reconstruction of an independently existing fabula.¹⁶ The viewer primarily experiences the film as a simulation of real life events that come into existence as the film progresses, although they know it is pre-recorded and told by some sort of narrator.

Unlike Bordwell's model, which takes the discourse as the viewer's starting point for grasping the story, the PECMA flow model is primarily story-driven. The canonical story is the basic mental structure for understanding actions within the world. So-called discourse elements of the film are better described as modifications to the canonical story form that create different emotional modes (such as tensivity or saturation) as described in *Moving Pictures*. The different modes foreground different aspects of the embodied brain. A discourse-based model is only curiosity-driven, but a story-driven model is not (although curiosity certainly plays a role in many genres, such as mysteries). A story-driven model is mainly based on central emotions like love, fear, hate, and their release, frustration, and extinction through the observation and simulation of actions and events. Emotions and cognitions are therefore totally intertwined.

The PECMA flow model also suggests that the fundamental perspective of the narrative drive is first-person as opposed to third-person, contrary to the thought and distant observer theories popular with Noël Carroll amongst others. Evolutionary considerations make it reasonable to suggest that third-person perspectives develop on top of first-person perspectives. To begin with, our mental architecture is developed to allow for a sophisticated navigation of our bodies in space so that we can obtain food, water, and mates, whilst avoiding predators and enemies. George Lakoff¹⁷ and Mark Johnson¹⁸ have proposed that to conceive of the world as a space for action is the basic mental model even in language and metaphors. Furthermore, brain scans suggest that third-person 'theory of mind' cognitions take place in neocortical modules, whereas first-person simulations takes place in the 'self' – modules adjacent to the limbic system and the pre-motor cortex.¹⁹ To claim that a third-

person perspective (that of the viewer in his or her cinema seat) is the basic one provides for a much more complicated viewing procedure. It is easier to follow a canonical film by simulating the mental states and actions of the protagonist by means of diegetic coordinates. The claims that I made in *Moving Pictures* for how viewers simulate the perceptions, cognitions, emotions, and actions of the protagonists have recently been given support by the discovery of mirror neurons.²⁰ These neurons are not only activated when one person performs actions, but also when that person observes that another performs such actions. Through mirror neurons, film narratives may activate strong first-person emotions. Third-person emotions like empathy or admiration are central to Carroll²¹ and Tan,²² but they exist side by side with first-person emotions like love, hate, and jealousy.

Stage 4: Action, Facilitation, and Blocking

The fourth and final stage of the PECMA flow model involves the vicarious implementation of those action tendencies that are the end result of the emotional processing described previously. Contrary to real life and video games, of course, when watching film the viewer is not able to act on what they see.²³ However, because of the enormous control that the filmmaker yields over the viewing process in the cinema – compared with, say, the artist's control over the spectator's attention in an art gallery – films are especially well suited to simulating affordances, or lack of affordances, for action. In the canonical case, the vicarious action tendencies are facilitated. If, for instance, the character on the screen takes control of the situation and overcomes the obstacles presented, then the viewer vicariously experiences voluntary, goal-directed, motor activity. In the non-canonical case, on the other hand, vicarious action tendencies can be blocked either narratively, through such means as character inaction and the 'lyrical' disappearance of the protagonist's goals, or stylistically, through such techniques as freeze-frame and extreme long shots. When this happens, the viewer undergoes one of two types of experiences. The first experience, common in elements of comedy,

melodrama, and horror, is an involuntary autonomic response such as laughing, crying, or fear. The second experience is a regression to the 'lyrical' and 'saturated' emotional modes typical of the second stage of the PECMA flow.

The similarity in emotional tone between melodramatic sequences that elicit negative autonomic responses and films with lyrical-associational forms is due to their common strategy of blocking action tendencies, which prevents the viewer from coping with the reality around her and initiates a change in her emotional response. Although active coping is central for survival, it is equally important to be able to switch off action tendencies in situations where action is impossible, when action takes place on a group level, or when the acceptance of some kind of loss is necessary. In this respect, tragedies and love stories use the same kinds of strategy to block action and elicit autonomic responses; this fact explains why there is often a certain overlap in imagery between the two genres and why the two genres are capable of enhancing each other when combined – as exemplified by tragic love stories such as *The English Patient* (1997).

III. Evaluation of Reality-Status and the Aesthetic Effects of Reality Modulation

The central element in disrupting the transition from emotion to (fully implemented) action is the evaluation of a film's reality-status. This is an area where a number of film theories suffer their Waterloo because they – like the Ptolemaic world view – are stuck with the appearances. Just as it was once commonsense to think that the earth is flat – a view which forced ancient philosophers to invent complicated theories involving epicycles and the like – it has also been commonsense to believe in a representationalist model of film viewing. According to this model, film viewing involves seeing images and these images represent something absent (for instance, a pro-filmic event). The images cause a state of 'disbelief' – in the sense that we see representations as opposed to the referents themselves – and the mind is required to perform

the noble art of 'suspension of disbelief'. From the perspective of the PECMA flow model, however, it is easy to see that what enters the eyes and the visual cortex are not representations, but light waves that cause neural activation. The humble neurons in the rear of the brain cannot distinguish representations from the real thing; the emotion-inducing limbic system will be activated whether we are confronted by a real wolf or by an audiovisual simulation of the wolf. The primary process when watching films is thus belief. Film viewing depends not on 'suspension of disbelief,' but 'suspension of belief' – diminishing our belief in what we perceive – because otherwise we would leave the theatre in fear when watching horror movies. This process takes place in and around the frontal areas of the pre-motor cortices. We may therefore save ourselves a lot of trouble regarding the reality effect of fiction by modelling the different steps in the reality evaluation process.

To understand the evaluation of reality-status and our experience of reality, we need to make an additional 'Copernican shift' in our understanding of the mind: we need to think of our eyes and ears as appendices for the muscles. Perception has evolved to enhance our ability to move our body around by means of the muscles and to increase our chances for implementing our preferences. Understanding the mechanisms of evaluating and experiencing reality is complicated if we assume that our conscious experience of the world is based on making an 'objective' copy in our minds. Grasping these mechanisms is much easier when we realize that our experience does not only depend on whether something actually exists, but on whether perception, cognition, emotion, and action can be integrated in order to help us cope with the physical and social environment.

A variety of research suggests that our conscious perceptions are soaked with those emotions that serve to guide our actions, so that what we see is not 'the world as it exists objectively or for some god's eye', but rather a pragmatic mixture that reflects our interests. According to Jaak Panksepp, even the qualia that

are central to our consciousness (like colour and shape) are used by the mind to emphasize or 'flag' the elements of space that provide a firm basis for action.²⁴ J. J. Gibson's theory of affordances implies that we feel what kind of action a given object affords: we do not only see a door, but also feel that the door affords passage.²⁵ Rudolf Arnheim has discussed how embodied feelings like heaviness and balance are felt as aspects of visual experiences.²⁶ Studies of synaesthesia reveal how we map possible tactile experiences onto visual images. Thus, feelings supplement the audiovisual world of qualia.

The role of reality-status in the PECMA flow model suggests that those mechanisms that have been developed to discriminate imagery (e.g., hallucinations, thoughts, and dreams) from online experiences of the exterior world are also used to inform our mental stop-go mechanisms: real is what is felt as affording 'go', unreal is felt as that which demands 'stop' or 'caution'. Feelings of 'irreality' may have many different causes, and I will point at just two. The input may be problematic, as when fog, darkness, mirrors, or screens make actions difficult or impossible, or the output may be problematic, as in the restricted actions of the central character in melodramas and horror stories.²⁷ In a strict sense, foggy landscapes are just as real as sunlit landscapes; the difference between the two is not one of objective existence. Evolution, however, has made our minds practical, so that difficulty in taking action is experienced in the same 'unreal' way regardless of whether the difficulty is due to perception problems or potency problems.

Many of the effects that are central to film aesthetics are due to playing with reality-status and action potentials. Specifically, the PECMA flow model has enabled me to provide a meta-theory of comic effects that integrates a variety of comic theories from over the centuries within a single framework. In *Moving Pictures*, I described how comic reactions are pleasurable bail-out mechanisms that evaluate a given arousal as being 'unreal', that is, not a cause for action and reaction. So, a series of very arousing events – from cruelty and shame to paradoxes –

may use laughter-related 'safety valves' that activate the limbic pleasure system rather than producing (re)actions. The evaluation 'unreal' is based somehow on mechanisms that distinguish sensations caused by one's own body and/or self-stimulation from sensations that have an exterior causation. When playing or being tickled we employ similar mechanisms, and it is well known that laughter-evoking drugs like hash partly destroy the sense of the exterior world. The ability to bracket the reality of actions that are performed in a playing mode is at the root of the mammalian cognitive revolution.²⁸

IV. Bottom-Up, Top-Down, and Reverse Flows (MACEPs)

Although the basic direction of the PECMA flow is from perception to action (as indicated by the name), it should be stressed that there are also reverse flows at all stages of the process. Granted, many aspects of perception take place in modules that are sealed off from feedback, as demonstrated by visual illusions such as the Müller-Lyer illusion which persist even after we know its causes. In general, however, the process of matching perception to memories and schemas involves constant feedback and is thus dependent on our knowledge and beliefs. Every change in our store of memories and schemas has the potential of changing some matching process. So, even if the general architecture of the mind is the same for all people, specific experiences are strongly influenced by the viewer's individual and cultural background.

The reality evaluation effects on perception represent a kind of top-down flow. If fog was only fog, and did not impede visual control and action, we would have neither the common lyrical-unreal experience of fog scenes in films nor the feeling of unreality when confronted with slow-motion. We would also not be able to distinguish between different kinds of unreality, such as dreams, fantasies about what could be real in the future, and sensory memories (which were previously 'real and online' experiences). Visual input would just be visual input. But from an evolutionary as well as a functional

perspective, perception is just a servant for making adequate actions and thus has to adopt forms and functions that accord with its master, the motor system. The intensity of the film experience is intimately linked to the way in which moving pictures allow for this constant interaction of perception, emotion, cognition, and action.

At the time I wrote the original version of the PECMA flow model, there was not much help from the psychological literature to understand how our experience of the 'bottom-up' PECMA flow interacts with a 'top-down' flow from frontal centres of the mind to the process of perception. The exception was Gibson's ecological theory which emphasized that our experience was based on affordances or action potentials. Tacit or explicit folk knowledge also implies an influence from interest to perception, holding that, for instance, our emotional evaluations colour our perceptions. In our experience of beauty, it is not really possible to distinguish emotion (such as the urge to contemplate and approach) from perception, and our experience of the ugly or dangerous is a mixture of perception, emotion, and action tendencies (the urge to avoid).

Recently, however, neurological research has made some advances in describing the top-down flow, showing that it is impossible to isolate perception from emotions, cognitions, and action tendencies. For example, neuroscientists have shown that although some neurons in the primary visual cortex are constantly activated and process the constantly influx of information from the exterior world, many other visual neurons are only switched on when a given phenomenon receives conscious attention.²⁹ Gerald Edelman and Giulio Tononi have described how the brain is full of what they term 'reentrant pathways' and 'back projections'.³⁰ In relation to film, this research suggests that the filmmaker may focus and refocus our experience on different stages (or 'brain locations') in the experiential flow. For instance, a film may focus our attention on basic visual or acoustic processes or it may focus our attention on those associative processes that take place in the so-called parietal cortex, where

emotional experiences exist in a depersonalized ('lyrical' or 'sublime') form. Alternatively, a film may prime our memory and attention by cueing expectations and probabilities, or it may focus on the world as a scene for action so that muscular tension exists as a tacit background.

The reverse flow may provide the framework for understanding the relationship between top-down processes (based on personal or cultural learning) and bottom-up processes (based on innate algorithms). Those visual-aesthetic effects known as 'illusions' clearly indicate that some bottom-up processes take place sealed off from any top-down interference, whereas other processes in the PECMA flow may be influenced by the reverse flow. These processes are still being studied, but understanding what are universal constants and what are variables in our experience of films (and the world) is central to future research within film studies.

V. Culture and Biology

Critics of a neurocognitive approach to film studies argue that it refuses to see film as a product of culture and history. They are both right and wrong. Right, because the innate brain architecture defines some fundamental and universal aesthetic laws, forms, and functions. Wrong, because the superior flexibility of this architecture has evolved to support an infinite variety of contents and a considerable variety of forms. Although the emotional system is universal, it is certainly an individual or cultural history that determines who and what we like and who and what we hate. Furthermore, due to the enormous survival value of variation (for instance, in eating or food-gathering), the thrill of tasty experiences will become habituated and thus create a need for novelty. The aesthetic experience is thus very much a historical product on both the individual and social level. General theory will also help us to understand that some phenomena are radically historical; for instance, when forms or contents are temporarily abandoned there may not be global reasons for this. When viewers at a given time have become tired of film noir it does not necessarily reflect a

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very general cultural climate, but may also be part of a cycle of taste determined by novelty-habituation.

A general film theory does not mean that film history is non-existent; on the contrary, the theory provides tools for understanding film's historical developments. The deeper reasons for much of the critique of general theory may be located elsewhere, in a strong resentment against scientific reduction, because the critics (erroneously, I think) feel that if films are moulded by innate features of the brain, the specific details of films are unimportant. However, our knowledge that apples fall to the ground according to the laws of gravity, and taste according to the chemical interaction of apple and mouth, does not make apples unimportant. Film studies should be more than a club of eloquent aficionados.

VI. Conclusion

Middle-level and piecemeal theories are not able to explain the fundamental laws of visual aesthetics; such theories are caught in a naïve realism that thinks that our experience of films is only one of external representations. The general theory that I advocate will adhere both to a radical constructivism (everything is a construction in the mind of the beholder) and to a kind of 'evolutionary' or 'pragmatic' realism. Central brain mechanisms that mould the film experience are not arbitrary but have developed over the course of evolution to provide fitness. Middle-level and piecemeal theories prevent adequate general descriptions of aesthetic and narrative problems, including descriptions of agency. Film studies is part of the humanities, and the historical study of film and the close analysis of specificity are valuable, not only in themselves, but also as a firm basis for more general considerations. But the film experience takes place in brains, and many of the mechanisms that produce that experience are just as invisible to an introspective approach as the course of the planet Earth around the sun is invisible to the eye. Therefore, it is necessary to make film theories that are informed by state of the art psychology.

Notes

- 1 Torben Grodal, *Moving Pictures: A New Theory of Film Genres, Feelings and Cognition* (Oxford: Clarendon Press, 1997).
- 2 Tico Romao, 'Review of *Moving Pictures*', *Scope* (2003). Available online at: <http://www.nottingham.ac.uk/film/journal/bookrev/books-august-03.htm>
- 3 Asbjørn Grønstad, 'The Appropriational Fallacy: Grand Theories and the Neglect of Film Form', *Film-Philosophy*, 6:23 (2002). Available online at: http://www.film-philosophy.com/vol6-2002/n23_gronstad
- 4 Christer Mattson, 'Anmeldelse af *Filmoplevelse*', *Film International*, 4:4 (2003). Available online at: <http://www.filmint.nu/netonly/eng/bokrecgrodal.htm>
- 5 David Bordwell, *Narration in the Fiction Film* (Madison, University of Wisconsin Press, 1985).
- 6 David Bordwell and Noël Carroll (eds), *Post-Theory: Reconstructing Film Studies* (Madison, WI: University of Wisconsin Press, 1996).
- 7 Bordwell, *Making Meaning: Inference and Rhetoric in the Interpretation of Cinema* (Cambridge, MA: Harvard University Press, 1989).
- 8 Bordwell, 'A Case for Cognitivism', *Iris*, 9 (1989): 11–40.
- 9 David Marr, *Vision: A Computational Investigation into the Human Representation and Processing of Visual Information* (San Francisco, W. H. Freeman, 1982).
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