Chapter 2

Perception, cognitive appraisal and emotion

2.0 Introduction
Reading is principally a visual act that involves the recognition and interpretation of socially-constructed semiotic signs.\(^1\) A study of literary reading processes, as this work is, should therefore devote some discussion to perception. When one speaks of perception one cannot avoid addressing the notion of cognitive appraisal because the former appears to involve the latter. Correspondingly, as the previous chapter has started to show, no discussion on cognition can circumvent emotion. These three topics, perception, cognitive appraisal and emotion, will be the main focus of discussion in this second chapter. Like its predecessor, this one will seek to highlight the many dynamic cognitive and neural processes that take place during reading. It will close with my own short discussion of the affective nature of cognitive appraisal that will be continued and expanded in a later chapter.

2.1 A brief history of perception
The roots of the Western study of perception in cognitive neuroscience and cognitive psychology lie in the philosophy of ancient Greece.\(^2\) One of the first accounts of vision and the brain comes from the fifth century BC philosopher Empedocles.\(^3\) He believed that the eye had come down to man from the goddess Aphrodite, who had “confined a fire in the membranes and delicate cloths; these held back the deep waters flowing around, but let through the inner flame to the outside”.\(^4\) This might be a somewhat fanciful account of perception, but it is surprisingly modern too in its dynamic and fluvial nature. A century later, the philosopher Epicurus claimed that perception was a matter of ‘films’ that were “given off by the object and that convey an impression to the eyes”.\(^5\) This bottom-up view of perception, also known as an atomist account, was later adopted by the first-century BC Roman poet and philosopher, Lucretius.\(^6\) Epicurus added that these emanations occur “at the speed of thought, for their flow from the surface of bodies is constant” (24). Like Empedocles’s claim, that of Epicurus involved a fluvial dimension, as he said that his theory of perception was like “ascending rain, drenching us in all the qualities of the object”.\(^7\) Aristotle, with his empirical world-view, also came down on the side of the philosophers who believed in the notion that visual information, including written information, streams upward into the mind of a viewer or reader through the retina.\(^8\) Another theory of perception was proposed by Epicurus’ contemporary, the mathematician and geometer, Euclid. Euclid’s ideas on the nature of

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\(^1\) Of course, for Braille readers the act of reading is a tactile event not a visual one. This mode of reading throws up a whole host of fascinating questions for cognitive science: questions that are unfortunately beyond the scope of my work.

\(^2\) The Greeks, in their turn, must have been influenced by older civilisations.

\(^3\) For an informed overview of the pre-Socratic philosophers see Kirk, Raven and Schofield (1983).

\(^4\) From Empedocles fragment 84DK. Also cited in Manguel (28). See further Padel (1992).

\(^5\) Cited in O’Connor (24) from Epicurus’ “Letter to Herodotus”.

\(^6\) See De Natura Rerum (On the Nature of Things).

\(^7\) Cited in Manguel (28). See also Lindberg (1983).

\(^8\) See De Anima (On the Soul).
perception were arguably less fanciful than the two already mentioned. They were still basically mono-directional, but in contrast to Epicurus’s views they were exclusively top-down. This is best seen in Euclid’s claim that “rays are sent out of the observer’s eyes to apprehend the object observed”⁹. The ancient Greeks therefore were quite divided on whether perception was a stimulus- or concept-driven process. Six hundred years later, the Roman physician Galen took a more unified view of perception than the Greeks had, although his starting point was still essentially a top-down perspective. He claimed that a ‘visual spirit’ in the brain “crossed the eye through the optic nerve and flowed out into the air”. This was the first stage of a three-stage process. The second stage, he claimed, involved the air somehow becoming ‘imbibed’ with the qualities of perception. The third and final stage involved the essence of the perceived object then being transported “back through the eye to the brain and down the spinal cord to the nerves of sense and motion”.¹⁰ Despite being linear and hierarchical in its structure, Galen’s theory did attempt to account for both a top-down and a bottom-up processing of perception.

This interaction between stimulus-driven perception, sometimes known as intromissionism, and concept-driven visual processing, known as extramissionism, was meaningfully expanded only in the Middle Ages, when the Basra-born Arab scholar, al-Hasan ibn al-Haytham (known as ‘Alhazen’ in the West) suggested a subtle division in what ‘seeing’ actually means. While studying optics in the first half of the eleventh century at the celebrated ‘Dar el-I’Im’ (‘the House of Science’) in Cairo, he set about combining some of Aristotle’s bottom-up ideas with some of Euclid’s top-down ones, finally coming down on the side of intromissionism. In doing so, he was able to make a radical distinction between ‘pure perception’ and ‘pure sensation’.¹¹ In Alhazen’s view, pure perception would refer to something like consciously focusing on words or calculations set out on paper, while ‘pure sensation’ might occur if you were to take your eyes away from those black marks on the page by simply turning your head sideways and gazing out of an adjacent window to apprehend an object like a piece of paper being carried playfully by the wind. Alhazen was thus arguing that perception involves a gradation of awareness that fluctuates from the conscious to the unconscious and, in effect, from cognitive processes to subconscious affective processes. This was one of Alhazen’s crucial observations, and, amazingly, it is not too different from some of the neuroscientific theories that are being put forward today. For example, a very loose analogy might be drawn between Alhazen’s ideas of ‘pure perception’ and ‘pure sensation’ and what was said in the previous chapter about the nature of explicit memory, mediated primarily by the hippocampus and implicit memory, mediated primarily by the amygdala. It seems to echo as well LeDoux’s idea on ‘the (explicit) memory of an emotion’ versus ‘an (implicit) emotive memory’.

2.2 The hardware of vision
When one looks at an object, how does one perceive it? Neurobiologists, aided by advancements in neural scanning technology, now believe that they have a reasonable idea of how vision functions. Perception appears to begin in perceptor cells that are sensitive to external stimuli. In the case of vision, this external stimulus is light, which falls on the retina. Photons are then transduced in the retina of the eye, which is part of the central nervous system, into electrical activity by photoreceptors at the back of the eye. There are two types of photoreceptors: cones and rods. The former are responsible for day-vision and the latter for night-vision. (See Figure 5).

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⁹ Cited in Manguel (28). See also Lindberg (1983).

¹⁰ All citations here are from Manguel (29). See also Galen’s On the Natural Faculties.

¹¹ In order to come to these opinions it appears he was very much inspired by the work of the second century Alexandrian scientist, Ptolemy (see Smith 1990). The manuscript in which Alhazen’s most important findings are located is known as De Aspectibus (see Smith 2001).
Figure 5: A close-up of the photoreceptors in the retina of the human eye

The process then flows from the retina to the thalamus, the sensory switchboard in the mid-brain. This whole operation occurs in parallel pathways, rather than in a single, serial one, which travel through both the sub-cortical and the higher cortical areas of the brain. These two routes are commonly known in cognitive neuroscience as ‘P’ and ‘M’. The ‘P’ pathway travels from the retina via the thalamus to the posterior parietal cortex — the approximate area that Zoll refers to as the integral back cortex — and then on to the primary visual cortex located at the back of the brain. This is a ‘higher’ route, so to speak, that is thought to be responsible for the processing of such phenomena as motion, depth and spatial information. This area is therefore more concerned with spatial and locative relationships. On its ‘return’ journey from the primary visual cortex it passes through the middle temporal region of the brain, which is concerned with motion and depth too. This return journey is known by a different name, namely the ‘dorsal’ pathway and can be said to pertain to the ‘where’ and ‘how’ of mental constructs. The ‘M’ visual pathway also flows from the retina via the thalamus, but then goes on to the inferior temporal cortex before it arrives in the primary visual cortex. This is a ‘lower’ pathway, as it were, that is more concerned with such phenomena as form and colour. This area deals with recognition tasks of people, places and objects as well. On its ‘return’ journey from the primary visual cortex, this route also takes on a new name, namely the ‘ventral’ pathway and can be said to pertain to the ‘what’ and ‘who’ of mental constructs. It is important to note that even though these two pathways have different functions, there is thought to be extensive interaction between them at all cortical levels. Exactly how this interaction takes place is still largely unknown to neurobiologists. What is known is that perceptual integration is likely to be a multi-stage process, interacting with many other important visual areas such as the pre-frontal cortex.

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12 The thalamus is located at the top of the brain stem. It directs messages to the sensory receiving areas in the cortex and transmits replies to the cerebellum and the medulla, controlling breathing and the heartbeat. (See Figure 2 in the previous chapter for the location of these brain areas).

13 In neurobiology this is sometimes termed ‘the binding problem’.

14 See Kandel & Wurtz (505).
All vision must involve the primary visual or ‘striate’ cortex, also known as the V1 area, and also the secondary visual cortex, known as the V2 area. However, there are other important ‘extrastriate’ visual areas as well known as the V3, V4 and V5 respectively.\(^\text{15}\) (See Figure 6).

**Figure 6:** *The visual areas of the occipital lobe and the dorsal and ventral pathways*

When we see, we experience such things as colour, form and movement in a single perception. However, these categories are in fact processed in different areas of the visual cortex, as has been described in the fluvial-like journey above. More specifically, the aforementioned V3 area is concerned with the processing of dynamic form, the V4 area is dedicated to processing colour and form and the V5 area is given over to processing more general aspects of motion.\(^\text{16}\) These areas should not be seen as operating in isolation. For example, even though it is true that both V3 and V4 deal with different aspects of form and are processed differently, it would be a mistake to assume that the one is processed exclusively via the ‘P’ system and the other through the ‘M’ system. Instead, as Semir Zeki points out, perception is a widely distributed activity (189). What is essential to this entire account of neurobiological perception therefore is the notion of ‘distributed processing’, namely that the processing of visual input is a procedure that involves many cortical areas of the brain. This mirrors what we have seen in the previous chapter with regard to memory systems. It is thus not a single *serial* procedure but rather a multiple *parallel* one that must, by its very nature, rely on interaction and ultimately on synthesis and confluence. As Kandel and Wurtz state “there are in fact extensive interactions between the visual pathways at almost all cortical levels, as well as reciprocal connections from higher to lower level both within and between pathways” (505). This observation suggests that the neural act of perception, which also includes the neural act of perceiving words on the page during reading, is a confluent, dynamic process.

As explained earlier, light falling on the retina is believed to be the primary bottom-up cue for the act of vision. By and large, this is in line with the aforementioned views of Epicurus and Aristotle. Perception, however, might also be triggered in part by internal input, as was argued by Empedocles, Euclid and Galen. This classical perspective on vision can be observed as well in very recent neurobiological research, for instance the work of Kandel and Wurtz, which suggests that “perception is based on inferences about the nature of our world that are built into the wiring of our brain by genetic and developmental processes” (495). Just as the Gestalt psychologists of the early twentieth century claimed, the act of seeing is, therefore, to some extent based on inferences and assumptions that our visual neural system makes as to what is ‘out there’ in the world, rather than purely on what physically appears to be ‘out there’ that gets triggered.

\(^{15}\) More recently a V6 region has also been discovered and mapped out (see Zeki 104-05).

\(^{16}\) Zeki (94-112 &166-70).
and channelled by light. This must be the case too for reading. How often, when reading certain phrases, clauses and sentences, do we read what we expect to be there, based on prior experience, rather than what actually is there. It should now be clear that vision is not a mono-directional process, be that bottom-up or top-down. Rather, although initial light input remains central, it is a creative activity that runs not just on external ‘reality’ but also on assumptions and inferences that assist in transforming such patterns of light into the full magnificence of our three-dimensional world. As Kandel and Wurtz state “[vision] involves more than just the information provided to the retina by any given stimulus event” (493). Perception is a continuous, ongoing process that also involves a constant interplay of top-down (belief-driven) and bottom-up (data-driven) processing.17

There is work done on neural aesthetics that focus mainly on vision related to emotion. In one prominent theory, neuroscientist Vilayanur S. Ramachandran sets out six ‘laws’ of visual-neural aesthetics, all of which were originally grounded in our biological evolutionary survival system18. These are (i) grouping (we first struggle to see that fragments belong to a whole but once we do we experience an ‘aha’ moment of gratification); (ii) symmetry; (iii) hypervisual stimuli (extended or multiplied patterns produce a big ‘aha’ jolt); (iv) peak shift (how over-exaggeration or caricature leads to increased pleasure); (v) isolation (the ‘less is more’ principle: outlines/sketches) and (vi) perceptual problem solving (whereby the search to solve the problem is as enjoyable as the final ‘aha’ of recognition).19

The idea that perception is a creative process, mediated as much by top-down processes (i.e. what is expected to be seen) as it is by bottom-up processes (i.e. what patterns of light really reflect onto the retina) is not a recent technology-led discovery. As suggested above, the early Gestalt psychologists made similar observations at the beginning of the twentieth century, when they showed with their figure and ground visual experiments, based largely on form and distance, that the idea of an ‘observing’ brain was in fact a fallacy, since the visual brain often assumes what is to be seen rather than just seeing it. As indicated in the previous chapter, this is also what Bartlett found in his literary reading experiments on remembering. In light of the above we may conclude that the ‘hardware’ of vision, as this section was called, is not that ‘hard’ after all, and that the so-called hard sciences appear to be in agreement that there is indeed far more to vision, both figuratively and literally, than first meets the eye. This fact is not unimportant for a study of reading processes and especially for a study of literary reading processes.

2.3 Perception and reading
It is generally accepted that when a person is reading his/her eyes are not in continuous motion over the page. Instead, the eyes move forward in a series of discrete movements known as saccades. This process can be seen most clearly in eye-tracking experiments. Cognitive psychologist Best describes the regular ‘jump-stop-jump-stop’ rhythm in the following way:

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17 Clore and Gasper (40).


19 Several of these appear to contradict each other while others show clear overlap. Moreover, these are essentially visual style figures: for example symmetry would be the scheme isocolon while hypervisual stimuli equates to the figure hyperbole.
Once launched forward, the eye must come to rest at some point, however briefly, and the movement of the eye cannot be altered in midmovement. During these motions, no information from the page can be gathered. Following the saccade, the reader fixates her eyes at one point on the page. During this fixation, the eyes are relatively motionless, and the work of reading is accomplished at this point. Typically, readers fixate for approximately 200 to 250 msec, and the saccade can be accomplished in about 5 to 10 msec (354).

Reading is thus not just about vision but also fundamentally a question of motor skills, as Zull explains:

To read, we must use the muscles in our eyes for focusing and for following the words on the page or screen. Each eye contains a small lens that is continually adjusted by small muscles in the eyeball, allowing us to focus on what we see. And, each eyeball is turned up, down, or sideways, by other small muscles, thus allowing us to follow the words along the page. The lens changes shape, and the eyeball moves as we read. Reading is an intense, focused use of the motor brain. Reading is action (205).

Other studies, like that mentioned previously of Just and Carpenter (1980), have suggested that this ‘jump-stop’ rhythm of reading can be more complex, and indeed often is, as readers appear to focus longer on what are termed ‘content’ words than they do on ‘function’ words. Readers appear as well to focus longer on words at the opening and closing of sentences. So, depending on the difficulty of the word and the importance of its positioning in the sentence, a reader can intervene in this automatic saccadic process and alter the rate — just as readers might also intervene in reading a much-enjoyed novel and slow down or even speed up.²⁰ Just and Carpenter further point out that reverse saccades, known as regressions, are sometimes launched in order to aid the comprehension process. Typically, fixations have been estimated at about three words, roughly ten characters either side of the fixation point. However, in normal situations cognitive rather than biological factors will eventually determine the processing rate, and the general overall speed of reading and comprehension.

In much of psycholinguistics, reading is thought to be limited to work done in the traditional language processing areas of the brain, such as Broca’s area and Wernicke’s area. Broca’s, as explained in the previous chapter, is located in the left frontal lobe, which is thought to be principally responsible for directing muscle movements involved in speech.²¹ Symptoms of Broca’s aphasia include difficulty in speaking, defective syntax and a lack of function words and abstract nouns. Comprehension, however, is often good. Wernicke’s area, on the other hand, is located in the left temporal lobe and is thought to be largely responsible for language comprehension. These two important language areas can be seen in relation to other key brain areas in Figure 7.

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²⁰ This will be expanded on and tested in chapter eight.

²¹ Kandel has noted how both visual and auditory pathways appear to converge in Broca’s area (14).
Figure 7: Broca’s and Wernicke’s in relation to other key brain areas

People suffering from Wernicke’s aphasia have poor comprehension, even though their speaking is by and large good: it is often syntactically complex and lexically diverse — although nouns and verbs are often simple. Recent developments in brain-scan technology, monitoring blood-flow during language tasks, have shown, however, that language appears to be stored in different locations across the human brain. Neurolinguist Friedemann Pulvermüller, for example, claims that words are represented and processed in the brain by “strongly connected distributed neuron populations exhibiting specific topographies” (1). He adds that these neuron ensembles are more commonly known as ‘word webs’. At a more specific lexical level he explains how concrete words referring to objects and actions are thought to be organised as widely distributed cell assemblies in the sensory and motor areas, while abstract grammatical function words and grammatical affixes are thought to be housed in the left cortical areas, as well as in Broca’s and Wernicke’s areas (49). Similarly, grammar functions in the brain are thought of in terms of ‘neuron assemblies’, whose activity relates to the serial activation of other neurons. As Pulvermüller explains, these are called ‘sequence sets’ (2). Neuronal sets are thus defined as functional webs that can have four states of activation, namely, (i) inactivity, (ii) ignition, (iii) reverberation, and, (iv) neighbour induced pre-activity. These serially ordered processes are known as ‘synfire chains’ and also as ‘reverberatory synfire chains’ (6). The work of neurolinguists suggest then that Broca’s and Wernicke’s areas are not solely responsible for the storage and processing of language, but are rather an important point of confluence that the tributaries of language flow through and converge in oral language production and reception.

22 As mentioned here and earlier, blood flow is crucial to memory and cognitive processing. FMRI scans register the magnetism in blood movement, which consists of water, oxygen and haemoglobin. Interestingly, fMRI-scans measure activity later, rather than when it actually occurs. This is because blood flow needs time to respond to a stimulus. In fact there is a 3–4 second delay in fMRI scanning — and the whole process of blood being redirected to a part of the brain to process information and then moving away again once the action has taken place can take up to 25 seconds in total. So what neurolinguistic researchers see on the monitor during language experiments using fMRI scanning equipment is not language being processed, but rather the ‘shadow’ or ‘echo’ of those processes.

23 In support of this sense of reverberation during language processing, Pulvermüller speaks too of ‘fast oscillations’ in the ‘rhythmic’ brain (274). This notion of a rhythmic brain is an idea that was mentioned earlier in the recent work of Buzsáki.
Although these areas are still very important to processing in both active and passive language use, they are not as singularly seminal as was once thought.

PET-scan studies have shown conclusively that reading relies heavily on processing work done in the visual cortex. Zull alludes to this with his claim that language is a tool for producing images (169). It has also been suggested by Drongers, Pinker and Damasio that “reading words and word-like shapes selectively activates extrastriate left cortical areas anterior to the visual cortex” and that “the processing of word shapes, like other complex visual qualities, requires that general region” (1184). Reading also requires the construction of mental imagery. As such, according to state-of-the-art neuroscience, reading is, to a significant extent a visual act, in more than one way. It can be argued that one of the most potent and affective modes of language processing that relies on the construction of mental imagery is the reading of literature. Hence, the mental imagery produced by reading a literary text, or for that matter listening to one, is more likely to primarily involve the visual areas of the brain – perhaps more so than everyday language would.

Despite the convergence of visual and auditory pathways in Broca’s area, recent experiments have shown that both processes are fundamentally different. In an experiment using PET-scan techniques involving two groups of subjects, the first group was asked to think about as many verbs as possible that would co-relate to a noun that they were presented with. This had to be done without vocalising the words. The second group was asked to do the same thing but to vocalise the words at the same time. The imaging showed that the patterns of activation were completely different. In the case of the group that generated verbs through silent thinking, Broca’s area and supplementary motor areas came into play, while in the case of the group that vocalised their thought processes, the auditory and peri-auditory cortices were primarily activated. Indeed, Alan Baddeley’s aforementioned work on a theoretical ‘articulatory loop’ model shows how silent speech — or sub-vocal rehearsal systems — that can be accessed for example by reading words or numbers, made use of brain areas in rhyming tasks based on consonants that the vocalising of them from short-term memory did not use. Baddeley’s experiments surprisingly showed that Broca’s area was essentially non-vocal. These experiments strongly suggest that discussions on silent reading processes, such as mine, should not avoid a consideration of Broca’s.

The above-mentioned experiments are from the late 1980s. Today, there are several other theories with regard to reading processes that have been supported by brain scanning. One worth mentioning here is discussed in Stanislas Dehaene’s 2003 article “Natural Born Readers”. Here, Dehaene addresses the question as to why it is that we can read so well while the human brain evolved in a world without words. He is looking in more depth at what Kosslyn and Koenig had earlier called “an example of opportunistic processing” (168). Dehaene suggests that the brain’s built-in flexibility diverts existing brain circuits to deal with the relatively new task of reading.

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24 This idea was also supported, in principle, by the aforementioned leading visual cortex expert and professor of neural science, Semir Zeki in my informal personal communication with him at Symposium of Concrete Art and Mathematics on 25 October, 2003, at Amersfoort in the Netherlands.

25 Some of the first to make this discovery were Posner et al in 1988. Their work showed that looking at words, i.e. reading, involved the visual cortex; listening to words involved the temporal-parietal cortex; speaking words involved the motor areas of the medial-frontal cortex and thinking about words involved the frontal cortex as well as Broca’s and Wernicke’s areas.

26 This is something that will be explored in the next chapter.

27 This research is reproduced in Saper, Iverson & Franckowiak’s chapter on “Integration of Sensory and Motor Functions” in the Principles of Neural Science (379).

28 Cited in Saper, Iverson & Franckowiak (360).
More specifically he argues that “we are able to learn to read because the primate visual system evolved to do a different job that was sufficiently similar to allow it to be ‘recycled’ into a reading machine” (30). His recent fMRI experiments have revealed that there is a vast network of cortical areas that are active in the different stages of reading. In fact, there appear to be about a dozen regions involved, spread across the entire brain (30). Imaging experiments have suggested that the region of the brain responsible for object recognition also plays an important role in word recognition, irrespective of the language or the alphabet/icon type employed. So even though we are not born with an area of the brain that is wired for reading, we all end up using the same object recognition pathway on the left side of the brain to recognise words during reading procedures (30). This suggests perhaps that even in a language like English, the visual shape of a word may play an important role in the initial phase of reading. English words, therefore, are by no means icons, similar to those found in the Chinese and Japanese languages, but from a neurobiological perspective they appear to be treated in a somewhat similar way.\(^{29}\) Interestingly, in primates, the visual homologue region — which is part of the ventral visual pathway that humans use for word recognition — is still entirely dedicated to object recognition.

The foregoing discussion has focused on perception as a key sensory input for reading. However, it would be unwise to consider seeing as the be all and end all of reading from a sensory perspective, as there is much more to reading than a visual dimension. Two lesser-known sensory areas that I wish to touch on here are the vestibular function, located in the ear, and proprioception, which is part of the somatosensory system. Although the vestibular system is mediated in the ear, it has in fact little to do with the actual act of hearing. The mechano-receptors that are involved in the hearing of regular auditory sounds are located in the hair cells in the ear and especially in the cochlea that pick up vibration. However, the vestibular sensory system is grounded in the position of the body in the gravitational field. Hence, gravity, rather than sound, is its energy stimulus, and balance is its modality. Like sound though, it has mechano-receptors. These are the hair cells located in the vestibular labyrinth.\(^{30}\) The second, equally unfamiliar sensory system is the aforementioned somatosensory aspect of proprioception. The type of modality that proprioception employs is concerned with posture and the movements of parts of the body, while its receptor class is based on the transitional notion of ‘displacement’. The receptor cell types in proprioceptive displacement are ‘mechano’ muscle and joint receptors. From all this, we can see that these two forms of sensory perception are linked.\(^{31}\) (See Figure 8).

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\(^{29}\) Many letters in the English alphabet started as ‘icons’. For example, the letter ‘A’ came from the Greek letter alpha, which in turn came from ancient Semitic, which used an upside-down letter A, resembling a bull’s head, to represent the word ‘bull’.

\(^{30}\) The neural processes that take place in one sensory area, like the ear, and those that take place in another, like in the eye, are not mutually exclusive operations. Rather, they are often so infused that we cannot tell the one from the other. An example of this is the phenomenon of vertigo. Vertiginous feelings often initially appear to be primarily visual; a phrase that is often heard in such situations is “whatever you do, don’t look down”. However, vertiginous feelings are not mediated by the eye but by balance, located in the ear which is ultimately part of the vestibular system.

\(^{31}\) Later I will show how both proprioception and the vestibular function play a meaning-making role in the reading of literature, in particular during highly emoted episodes of literary reading at closure.
As has already been alluded to, there are certain parts of the brain, such as the pre-frontal cortices and the amygdala that represent information and feelings about a person’s body. They also control the state of the body. Damasio refers to the feeling that we have about our body as ‘somatic markers’. It is believed that the body can indicate these changes back to other parts of the brain via the somatosensory cortex. This input then becomes part of the meaning-making appraisal maelstrom that is played out in working memory. Damasio notes that, amazingly, the role that the body plays may, at times, be temporarily ‘bypassed’, as it were, so that the amygdala and the pre-frontal cortices can have a direct effect on the central processing parts of the brain. In other words, the affective areas of the brain can trick these processing parts into believing that the body is relaying information back that it is in a particular state, when it is not (See Damasio 1994 throughout and Kintsch 1998). Recall from the previous chapter how Kintsch evaluated his own emotive and somatic reactions when looking out of a window. There we saw just how important Kintsch thought these implicit memory inputs were for processing procedures. In support of this, and moving the discussion more squarely into the domain of emotion and perception, Kintsch further claimed that if somatic markers of a person’s own body are always present in working memory, then we must fundamentally adjust our ideas as to what perception is (410).

In sum therefore, one is indeed encouraged to conclude that perception is not merely a matter of what is ‘out there’, e.g. what can be visually perceived and what is normally processed in a framework of beliefs, but also what is ‘in here’, so to speak, with regard to feelings and an awareness of one’s bodily states. Perception, as Damasio argues throughout Descartes Error, is more than mere sensual information: it has an inherent somatic component as well. Kintsch agrees:

Perception is not only a cognitive process but also an emotional process. We react to the world not only with our sense organs but also with gut-level feelings. The things that excite us, please us, scare us are most closely linked to the somatic level. Our most central memories are the ones most intimately linked to our body (412).

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32 This has been echoed in some ways by Prinz, who, writing on emotions in general, views them as ‘somatic appraisals’ (143).

33 Kintsch does not say how and where somatic markers operate in working memory. I will address this in chapter eleven in the context of acts of engaged literary discourse processing.
Although difficult to test empirically, this claim appears to cut down in one fell swoop many of the past philosophical claims that the mind is originally merely a tabula rasa. Such ‘blank slate’ perspectives, including Locke’s famous claim that ‘there is nothing in the mind before it is apprehended by the senses’ now seem implausible in the light of modern neuroscience, which, supported by imaging technology, shows the crucial role of both bodily and affective inputs in perception and meaning-making. In the third and final part of this work I will argue that during certain phases of intensely emotive literary reading at closure, a reader is capable of experiencing a sense of felt movement. But how, one might ask, can a person possibly experience the feeling of motion without actually moving? The answer, in part, may lie in the proprioception and vestibular functions mentioned earlier, but it may also have something to do with a recently-discovered phenomenon called mirror neurons, which lends tangible, empirical weight to the cases of both proprioception, the vestibular function, as well as to similar theories like that of simulation.

2.4 Mirror neurons

The following description pertains to recent neurobiological research conducted on macaque monkeys completing a number of grasping tasks involving switches and knobs.

A unique type of neuron has been discovered in the lateral ventral premotor area. Like others, these neurons discharge when the monkey performs a specific grasping movement, but they also discharge when the monkey observes the same movement being made by another monkey or even by the experimenter. These neurons have been called mirror neurons (778).

Mirror neurons are located in the premotor area of the brain. More specifically, they fire in what is known as the F5 area of the ventral premotor region of the neo-cortex of macaque monkeys. Interestingly, this area is generally analogous to Broca’s area in humans, an important area, as has been shown, to language production and silent reading. Moreover, at the level of the individual neuron these visual responses are matched with motor ones. Hence, there is a confluence of perception and movement at the level of the single mirror neuron: something Rizzolatti, 

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34 In highlighting Locke’s ideas, I am by no means suggesting that the continental rationalists were right. Descartes’s essentially Platonic dualistic view of how the mind worked, largely devoid of integrated emotion and bodily states, is arguably even further removed from what contemporary neuroscience is suggesting.

35 Broadly speaking, simulation theory can be said to be “humans using their own mental processes to predict or understand the mental processes of others” (Vogeley and Newen 136). Simulation then, sometimes used interchangeably in certain contexts with the expression ‘theory of mind’, would be admirably suited for testing in the domain of literature. (See, for example, Zunshine, 2006 for an execution of this).

36 It is, of course, impossible to conduct such direct invasive experiments on humans. This, however, may not be necessary as Stamenov and Gallese have noted that macaque monkeys have proved to be suitable analogous objects of study, because human mirror neurons must operate in the same fashion as in these primates and probably even more flexibly (1-2).

37 Cited from Krakauer & Ghez. At the source of this discovery are two seminal articles: Rizzolatti and Arbib (1998) “Language within Our Grasp” and Gallese and Goldman (1998) “Mirror Neurons and the Simulation Theory of Mind Reading”.

38 See McGlone, Howard and Roberts for more on this (125).

39 Fogassi and Gallese (18).
Craighero and Fadiga refer to as “visuomotor neurons” (37). In light of the above, mirror neurons can be said to be quite a discovery. However, even more surprisingly is that not only do these neurons fire in the experiments when a monkey watched another monkey grasp a switch, or even when a monkey watched a lab researcher grasp the switch, but they fired as well when the monkey just looked at the switch, without grasping it or without seeing someone else grasp it. In light of the conjecture that ‘what works for grasping should also work for any other aspect of limb movement’, and that ‘the motor systems in primates and humans are remarkably similar’, this astonishing discovery reveals two things. First, if from a stationary position we visually perceive in the real world or on film or television someone making a limb movement such as waving, stretching out one’s arms, jumping, dancing, etc., then we too, as observers, may somehow be capable of almost feeling the full sensory extent of that movement. If true, this would go some way toward explaining why we sometimes feel that we can jump fences with racehorses, while we are watching steeplechases on TV, or soar upward with eagles or perform dances with entertainers on stage — all while we are still seated. The second astonishing thing revealed by this discovery is that if we only visually focus on an object that we have previously interacted with — without the presence of the actor or agent — then we will still be able to ‘feel’ or ‘experience’ a similar movement. So, in effect, one does not actually have to see an eagle either on TV or in reality in order to feel a soaring sensation; one only needs look up at the sky or look into a valley or canyon. Hence, some kind of emotive or empathic ‘projection’ appears to take place. This idea may seem somewhat fanciful. However, McGlone, Howard and Roberts have pointed to the covert nature of the working of mirror neurons: a position supported by Stamenov and Gallese’s claims on the fundamentally unconscious nature of mirror neural activity (2). They also add a crucial, and to my mind essential, emotive dimension to mirror neural activity by claiming that this covertness provides a feeling of “empathy or familiarity in the observer” (133). Following Grafton et al. they suggest too that this must be the case, as the observed action has, by definition, to be one that is in the observer’s behavioural or, just as importantly, imagined repertoire (133, my emphasis). This ‘imagined’ category takes mirror neurons a step further as it opens them up to the domain of mental imagery.

Intriguingly, mirror neurons also have both a linguistic and a social dimension. With regard to the first, Stamenov and Gallese have suggested that mirror neurons may play a role in helping to sort out one of the main puzzles in linguistics, namely the emergence of the language faculty (2). This has also been claimed by Rizzolatti and Gallese and more recently by Gruber, who asserts that the evolution of the premotor cortices did not merely form the neuronal basis for language functions, but that it strongly affected working memory capacity and other higher cognitive functions too (77). Gruber was, in part, able to make this claim exactly because the F5 area in macaque monkeys, where mirror neurons fire, is analogous to Broca’s area in humans.

40 Krakauer and Ghez confirm this when they state that “[c]ells fired selectively when particular switches were grasped and also fired when the monkey visually fixated the same switch without grasping it” (778).

41 With regard to the last of these examples, Boker and Rotondo (2002) have also conducted socio-cognitive work on the role that mirror neurons might play in dance.

42 At a more instinctive level, mirror neurons might also help to explain the enactment power of visual, and even auditory, pornography and, for that matter, at a more abstract, imaginative level, the effects of sexual fantasy.

43 In a similar fashion to my examples above, the authors have suggested that “this might underpin the attraction of watching football matches, boxing or evocative films, in that the observer is ‘on the pitch’, ‘in the ring’ or ‘emotively engaged’ whilst remaining motorically passive” (133).

44 Gruber has shown in his experiments on the effects of articulatory suppression in memory performance how Broca’s area and other premotor areas are crucial to working memory (84).
Moreover, as we saw, not only is Broca’s important for language production and silent reading, but it is essential too for some of the performance tasks in working memory. It can be said too that mirror neurons are not exclusively biological but social too. Since they are important for the grasping tasks of macaque monkeys, and for an action-understanding ability in general, these neural structures must also play an important social role for the whole group and inter-subjective relationships within the group and between individuals. This must be the case as well for humans — especially since linguistic communication is our primary means of creating and maintaining social bonds.

Many current accounts of mirror neurons within a human framework tend to omit two issues that to my mind must be central to mirror neural activity: memory and emotion. One study that does not side-step these issues is Morrison’s neuro-social work on neuroscience and cultural transmission. In this work, Morrison observes that mirror neurons fire at an early visuomotor stage of processing. From this she concludes that “memory processing of this information probably occurs downstream from mirror perception” (335). In effect, Morrison is saying that the feeling of movement comes before the actual memory of the event. She continues in the same fluvial mode by suggesting that “mirror perception more likely contributes at a relatively early stage to a cascade of responses which couple perception with action, and action disposition with memory” (338). Morrison also observes that mirror neurons probably play a role in cultural transmission and that the mirror system in humans probably does not have a single function but instead can contribute to “a gamut of social cognitive phenomena” (338). Mirror neurons, she concludes, hold great promise for knowledge on how the workings of the brain contribute to the workings of culture (339).

In light of the above it can be posited that mirror neurons do indeed appear to be a fruitful phenomenon for studying literacy language processing, and the notion that there may be a felt movement resulting from heightened emotive bodily response to that processing. Moreover, the physiological notion of mirror neurons also appears to give substance to much of the past theoretical work done on simulation. Indeed, Vogeley and Newen note that mirror neurons provide ‘valid evidence’ for simulation theory (147). Additionally, mirror neurons might go some way to elucidating how the somatosensory system operates. As Damasio has claimed, somatic markers involve a number of brain regions including the prefrontal cortex, which is housed close to the pre-motor area. Perhaps one of the most enticing claims is Morrison’s previously highlighted suggestion that mirror neurons fire at an early stage of visuo-motor processing and that, as a result, memory and the bulk of cognitive processing occurs ‘downstream’, as she puts it. She implies that emotions have primacy here — in effect, that emotive processing takes places before the bulk of higher cognitive processing. This may be somewhat controversial. I shall now look in greater detail at the old and often heated debate as to what is said to come first: cognition or emotion.

45 Other linguistic claims have been made which appear to go much further. Just one example of this is McCune’s assertion in her cross-linguistic study on biological motion that “the mirror neuron system may prove the link between single words and syntax” (320).

46 This general idea of a confluence of the neurocognitive and the social in the mirror neural assemblage is supported by Fogassi and Gallese, who discuss at length the likely social cognitive function of the mirror system (31).

47 Action disposition is concerned with emotion and more specifically with what Damasio has termed ‘somatically marked’ emotions.

48 Stamenov and Gallese seem to be correct when they say that it is hard to underestimate the importance of the discovery of mirror neurons (1).

49 Descartes’ Error (180-83).
2.5 Cognitive appraisal and emotion

Cognitive appraisal is said to be principally a linear process in which a stimulus is first perceived in the world, then a judgement or belief is cognitively constructed about the perception of that stimulus and finally an emotion is experienced about the original stimulus based on one’s beliefs or judgements. This is a doctrine that is still widely held in cognitive psychology. For example in *Passion and Reason* Richard S. Lazarus and Bernice N. Lazarus describe cognitive appraisal as follows:50

An appraisal — on which emotions depend — is often a complex judgement about how we are doing in an encounter in the environment and with our lives overall, and how to deal with potential harms and benefits. Appraisal is not just passively receiving information about the environment. It must also actively negotiate between our personal agendas— that is, goals and beliefs (144).51

At first sight, this appears to be quite modern. However, modern psychology sometimes overlooks a very rich philosophical debate on this, which has been ongoing since Antiquity. In *Philebus*, for example, Plato suggests that without thought, memory and a true belief there can be no awareness of pleasure, and hence no pleasure can take place (21a-d). Similar viewpoints are also found in other works by Plato. In *Phaedo* for example, he recalls Socrates’s monologues which highlight one of his main beliefs, namely that the body is a hindrance to philosophical investigation (65-a/b):

Surely the soul can reason best when it is free of all distractions such as hearing or sight or pleasure or pain of any kind — that is, when it leaves the body to its own devices, becomes as isolated as possible, and strives for reality while avoiding as much physical contact and association as it can (65-c).

For Socrates, therefore, ‘flawless’ comprehension had to be approached not with the body but with ‘unaided intellect’ (65-c), i.e. “without taking account of any sense of sight in his thinking, or dragging any other sense into his reckoning” (66-a). His object of desire was the attainment of ‘truth’. In order to achieve this one had to get rid of the ‘contaminated’ body, since “the body fills us with loves and desires and fears and all sorts of fancies and a great deal of nonsense, with the result that we literally never get an opportunity to think at all about anything” (66c). Socrates adds: “so long as we are alive, we shall keep as close as possible to knowledge if we avoid as much as we can all contact and association with the body;” (67-a). What Plato appears to suggest is that emotions do not simply happen to us, rather we have to have a ‘belief’ or indeed make a ‘judgement’ before they can take place. In such views, emotion can be said to firmly operate under the exacting control of cool cognition, which is very similar to Lazarus’s view cited above in which emotion “depends on” cognitive appraisal. This standpoint can be encapsulated by the maxim ‘every emotion must first be cognitively appraised by means of a belief or a judgement’.

Following Plato, one of the most well-known philosophical devaluations of the body and the emotions was put forward by René Descartes, who thought that it was difficult to rely on our senses to tell us what is happening in the world and in our minds. In order to understand the world better, he wanted to start from zero by disregarding what had already been said in philosophy. Descartes’s doubt in everything led him to his famed conclusion that nothing in the world can be true — except of course for his doubt. In effect, it can be suggested that he was not doing much more than echoing St. Augustine’s dictum *Si fallor sum* (If I doubt, I exist). Descartes then

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50 Since the theory expounded here is part of Richard Lazarus’s ongoing work, I will refer only to him in subsequent references.

51 This perspective on emotion in the appraisal process is one that runs through much of the influential work of Lazarus.
extended his doubt to the place where ‘doubting’ was formed and came to his celebrated conclusion that reason and the mind are all that can be trusted: in other words, cogito ergo sum.⁵² Lazarus’s above-mentioned rational views on appraisal do not appear to be too dissimilar to these prominent pre-twentieth-century philosophical views, stretching from antiquity to the seventeenth century. The only difference is that whereas almost all of these philosophers tended to see emotion as being separate from reason, Lazarus appears to see it as being included in cognition — albeit, as the quoted passage shows, always in a subservient position to reason and judgement.

We see from the above summary just how many of the major pre-twentieth century views on the emotion-cognition debate came down on the side of reason. This changed radically, however, with the advent of psychology in the late nineteenth century, which posed the questions ‘does one feel an emotion after one notices one’s physiological response?’ or ‘does one feel an emotion after one has realised that one is experiencing one?’ Put differently, one could ask ‘does one feel sad because one is crying?’ or ‘is one crying because one feels sad?’ The main point here is whether one feels before one thinks or whether one thinks before one feels. Common sense tells us that we cry because we are sad and we hit out at somebody because we are angry, but the founding father of psychology, William James, suggested at the end of the nineteenth century that the reason we are sad is because we are crying and the reason that we are angry is because we have already hit out at someone. In other words, we can feel before we think because to experience an emotion is to be aware of our physiological reaction.⁵³

James’ theory of bodily superiority was soon challenged in the 1920s by the physiologist Walter B. Cannon, who made the telling comment that the body’s responses are not distinct enough to evoke all the different emotions that we label linguistically. Cannon posed the question: ‘what does a racing heart actually signal?’ Granted, it can indeed be fear, but it can be something like love as well, which both linguistically and conceptually appears to be the opposite kind of emotion to that of fear. Cannon further noted that physiological changes, like perspiration or the quickening of the heart-rate take a second or two. This may seem quite fast in everyday terms, but in neurobiological ones, where neural activity can take place in a thousandth of a second, it is very slow. Cannon thought that this was indeed the case and said that bodily changes occur far too slowly to trigger sudden emotion. Hence, he suggested that physiological arousal and emotional experience must occur simultaneously.⁵⁴ Technically, this viewpoint suggests that there is a simultaneous bodily and cortical interaction via the nervous system. So one’s heart starts pounding exactly at the moment one experiences fear, not before or after it: so there is no real cause or effect. If James said that emotions can occur independently of cognition, Cannon responded that the emotions which we experience involve cognition too. Following Cannon, Stanley Schachter and Jerome Singer tried to move the discussion forward by suggesting that the experience of an emotion involves two ingredients: physiological arousal and a cognitive label for it.⁵⁵ Both, they claimed, are needed to express an emotion. This contributed to the idea that an

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⁵² Having said this it should be noted that in his final major work, the much ignored Passions of the Soul (1649), written a year before his death, Descartes softened his dualistic assertions considerably. Here, in his fluvial theory of ‘hydraulics’, he maintained that the brain and body were in fact a single entity, connected by the pineal gland (located at the back of the brain) which he also believed to be the seat of the human soul. In sum, one might conclude that Descartes’ ‘error’ (See Damasio 1994) only remains so if one chooses to look at only part of the picture.

⁵³ These ideas which first appeared in James’s 1884 article were critically addressed in Cannons’ “The James-Lange Theory of Emotion: A Critical Examination and an Alternative Theory” (thus named in recognition of similar parallel work done by the Danish physiologist Carl Lange). See also David G. Myers’ discussion “Emotion” (433-61) upon which much of my overview has been based.

⁵⁴ This is known too as the ‘Cannon-Bard Theory’ in recognition of the similar work done by physiologist Philip Bard.

⁵⁵ This is primarily explained in their 1962 article.
emotional experience always needs to be consciously interpreted, which, in turn, suggests that all emotions must be cognitively appraised, i.e. founded on a belief or judgement. The view is still widely held in certain quarters of mainstream cognitive science, as can be seen from the quoted passage from Lazarus. However, it is a perspective that is coming under increasing pressure.

In the 1980s and 90s this debate was re-ignited as a result of advances made in neurobiological imaging technology. The Schachter and Singer position can be said to be roughly that of psychologists like Lazarus and his co-workers. Conversely, the James position is more clearly observed in the current theories of neurobiologists like LeDoux and Robert B. Zajonc. Proponents of both positions generally argue for the primacy of one of the two: cognition or emotion. Zajonc, for example, was one of the first brain scientists to suggest that emotion can precede cognition in cerebral processing activities. This is best seen in his two articles from the early 1980s: “Feeling and Thinking: Preferences Need no Inferences” and “On the Primacy of Affect”. Rapidly evolving brain-scan technology allowed him to seriously question the accepted view that all primary processing takes place via the higher cognitive areas of the neo-cortex. Zajonc’s insights have since been supported by LeDoux (1986), whose experiments have shown that in some cases a kind of ‘parallel processing’ can take place when subjects are exposed to a stimulus. The first of these processing pathways — which should not be confused with the ‘P’ and ‘M’ visual pathways mentioned earlier — is purely cognitive and takes place essentially via the neo-cortical areas of the brain. The second processing pathway is seemingly more ‘affective’ in nature, as it moves from the stimulus to the thalamus and the amygdala, located in the subcortex. This second route appears initially to bypass those cortical areas that are presumed to be given over to higher cognitive processing. LeDoux’s most convincing finding is not that parallel processing indeed takes place, since the notion of cross-neural, multi-mapping was already becoming accepted at the time in neuroscience, but rather that this second affective processing pathway is consistently faster than the cognitive route. These neuropsychological findings have since been supported by further empirical evidence put forward by Murphy and Zajonc (1993), who suggest that an emotion-laden visual stimulus, presented outside of conscious awareness, may colour our impressions and judgements to a degree unparalleled by other information. So one might conclude that this research, though far from being definitive, persuasively suggests that initial affective processing can sometimes take place prior to higher cognitive processing when subjects are subconsciously exposed to visual stimuli that are thought to contain affect-prompting properties.

In his later work, The Emotional Brain (1998) LeDoux is more specific. Here he argues for a ‘high road’ and a ‘low road’ with regard to stimuli reaching the amygdala resulting in emotion. The high road takes the route: stimulus-thalamus-cortex amygdala, while the low road goes from stimulus to thalamus to amygdala. This thalamo-amygdala trajectory is not only shorter, but faster too. This is in part due to the fact that the cortical route has more connections to the amygdala. The lack of higher cortical intervention in the low-road route means that the amygdala is presented with crude representations of the stimulus; it is what LeDoux calls “the quick and dirty processing route”, whereas the high road will give a much better quality of picture (164).

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56 In perception terms the argument is roughly equitable with intromissionism versus extramissionism.

57 As my work develops I will go on to look at the processing involved during certain literary reading situations, especially ones where intense emotions come into play.
Figure 9: A basic representation of the low and high road to emotion (LeDoux 1998)

Employing this theory within a framework of aesthetic appreciation in literature and the other arts, Patrick Colm Hogan (2003) asserts that although the subcortical arousal of the low road is ideal for film, it is apparently not suited for literature (176). He echoes this by stating “we will have (low road) emotional responses to film, theatre, photography and music—but not to literature” (179). The attention and constant cognitive processing that is needed to read literature probably led Hogan to this seemingly logical conclusion. Literary emotion, it would appear, takes exclusively a ‘high road’.

It is worth noting that we often encounter this James/Zajonc/LeDoux perspective on affective primacy in cognitive processes in critical discussions on many of the arts. Consider, for example, the following text, which appeared at the entrance to the room where a number of Francis Bacon’s paintings were exhibited at the Tate Modern in London:

Bacon believed that to communicate reality the painter has to capture not only the look of things but also the emotions that they arouse. In an attempt to generate images as accurately off his nervous system as he could, he sought to bypass reason in order to express feelings directly.

Although Bacon may not have been aware of it, his aim of trying to evoke feelings directly ‘off the nervous system’, somehow circumventing cognitive reasoning, makes him a committed physiologist, as indeed many artists are — and understandably so. Comparable affective claims within sister aesthetic domains can also be found in abundance. From the literary domain, for instance, there is John Keats’ famous, yet implausible, yearning “for a life of sensations rather than thoughts”.

Similar sentiments have been made in the film world. For example, filmmaker and dramatist Ingmar Bergman has observed:

When we experience a film, we consciously prime ourselves for illusion. Putting aside will and intellect, we make way for it in our imagination. The sequence of pictures plays directly on our feelings. Music works in the same fashion: I would say that there is no art form that has so much in common with film as music. Both affect our emotions directly, not via the intellect.

58 I will return to Hogan’s claim later.

59 The exhibition of this Anglo-Irish painter took place when Tate Modern first opened in summer 2000.

60 In a letter to Benjamin Baily, dated November 22, 1817.

61 From his “Introduction” to Four Screenplays.
Bergman, like Bacon, Keats, and, indeed, many other artists before him, claims that emotion is prior to cognition for the person who engages with an art form. All of these views fall broadly in line with James’s claim about the primacy of physiology in thought processes and, to some extent, with the modern neurobiological claims of both Zajonc and LeDoux. Although these views may appear to lack solid grounding, they cannot be simply labelled erroneous. Instead, one may suggest that if they fall short, then this is because they lack a certain nuance. As we have seen, all visual processing, whether it be of literary words on the page or art objects in space, requires, at the very least, activation of the visual cortex, which is a core cognitive system. We have also seen how external information can only reach the visual cortex by travelling from the retina via the thalamus. These processes cannot entirely bypass cognition, nor does internal visual input that gets activated from a person’s memory systems located throughout the brain as seen in the previous chapter. What these artists seem to be alluding to here is not non-cognitive emotion but rather what might be termed ‘affective cognition’, similar in some ways to Alhazén’s perception views on ‘pure sensation’, or what LeDoux referred to as ‘an emotional memory’ and the ‘low road’ to emotion. Affective cognition is undoubtedly a cognitive process, but one where emotion plays a dominant role.\(^\text{62}\) To return to my discussion, works of art may therefore activate in viewers and readers certain affective cognitive structures, perhaps even mirror neurons, in implicit, emotive and somatic ways. The result is a completely different kind of initial cognitive processing, not the kind that is based on beliefs or judgements or reason, such as that described by appraisal theorists, but rather one based on an affective cognition special to personal encounters with works of art. To conclude this discussion for the time being: both the Lazarus and Zajonc positions, in their most absolutist forms, seem to pose more questions than they answer. To my mind there must be a way of arguing that emotion is part of cognition without becoming a pure judgement-based rationalist.

2.6 Emotion in the mind and brain

Many psychological accounts of emotions seem to focus on what can or what cannot be classified as a ‘basic’ emotion. One such account, and a prominent one, is that of Oatley & Johnson-Laird (1987), who claim that there are five basic emotions (happiness, sadness, fear, anger and disgust). This is a popular division in the field. However, it is perhaps best to heed Oatley’s later comments in Best Laid Schemes that there is no absolute taxonomy of emotive words (83) and, as such, “the most prudent course is to be agnostic as to exactly how many basic emotions there are” (61). I will follow this sound advice here. In addition to categorising basic emotions, psychologists often classify types of emotion labels. Oatley and Jenkins (1996), for example, make the following basic distinction (375-81):

| Emotion: | A state usually caused by an event of importance to the subject. It typically includes (a) a conscious mental state with recognizable quality of feeling and directed towards some object, (b) a bodily perturbation of some kind, (c) recognisable expressions of the face, and, (d) a readiness for certain kinds of action. |
| Affect:  | A general term used to include emotions, moods and preferences. |
| Mood:    | A maintained state of emotion or a disposition to respond emotionally in a particular way that may last for hours, days or even weeks, perhaps at a low level and perhaps without the person knowing what started the mood. |

\(^{62}\) I will say much more about affective cognition later in this chapter and more explicitly in later ones.
The main distinguishing factor here appears to depend on intensity, however; to judge emotions this way alone would be too simplistic. In *The Emotions* Nico Frijda argues that a distinction ought to be made between concepts like ‘feeling’ and ‘emotion’ based not simply on intensity but rather on nature. Fear, for instance, is not necessarily always more intense than something like apprehension. Frijda describes emotion as ‘felt action tendency’, while feeling, he says, is a sense of ‘enhanced’ or ‘impeded’ functioning. He adds that “certain objects or situations elicit feelings’; (while) opportunities and risks in obtaining or avoiding those objects or situations elicit emotions” (244-5). ‘Feeling’, Frijda further claims, has many meanings (251). However, it does not simply refer to emotions of a ‘lesser’ intensity, since weak emotions, e.g. milder cases of happiness, can be inferior to more powerful feelings, like indignation or disgust. Like Frijda, Damasio sets out a long discussion on feelings and emotions in *Descartes’ Error*, in which he claims that “although some feelings relate to emotions, there are many that do not”, adding “not all feelings originate in emotions” (143). He is referring here to something important he calls ‘background feeling’, which he differentiates from mood, because it corresponds to the body state prevailing between emotions, calling it the “image of the body landscape” (150).

In addition to feelings and emotion, Frijda also speaks of concepts like sentiment, passion and mood. Sentiments, he says, are feelings in which ‘object evaluation’ is the major situational meaning component. Passions, are ‘goals’, springing from action tendency in which a current or desired situation is of great importance. Mood he claims is used to refer to an affective state, usually of longer duration than emotion, feeling, passion or sentiment. He further points out that mood is often elicited by some biochemical activity, i.e. an internal rather than an external event (252-3). Despite these classifications one should take heed of Frijda’s advice that “emotions, moods, feelings, sentiments and passions are not sharply separate classes of experience (…) Feelings may turn into emotions (…) Moods and passions may form the background for emotions” (253). In sum, emotion words and the concepts that underlie them might be said to be dynamic and context-dependent. Frijda also maintains that emotional experience can take three different forms: (i) awareness of situational meaning structure, (ii) awareness of autonomic arousal, (iii) awareness of action readiness. Each can be used to define emotional experience and the three forms often occur together (256). He says too that emotional experience in its most prototypical form is “a complex of the three kinds of awareness: situational meaning structure, arousal and action readiness, with hedonic quality involved in each” (249).

Above, Frijda links passions to goals, in which a current or desired situation is of great importance. Cognitive science informs us that emotions are heavily reliant on goals and the plans that lead to goals (Oatley 98). But how does all this pertain to the reading of literature, if at all? It is thought that when we read literature we do not have any goals, in the emotive sense, or rather “the goals and plans that bear on emotions are not ours” (Hogan 148). This hypothetical postulation is correct if we view the plot and characters as channelling our emotions, but it becomes problematic if we approach it from the macro-level of readers looking to be emoted by an art object. In literary reading there are then two sets of plans. Our own individual goal as a reader to be emoted by a text — this is akin to a desire and can be active long before the eyes meet the page — and the goals of characters with which we become involved and emoted because of our ability to empathise and simulate: in Aristotelian terms, we pity their misfortunes and in doing so fear for our own situation as we project those fictive events onto our own lives and loved ones. My concern, however, is with the first of these: the ‘real’ reader. It is true that twists and turns in the plot and the fate of the protagonist or narrator do create emotions in readers and

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63 See Frijda 1986 (especially section 6.5) for a much more in-depth account of this. See also his various definitions of emotion concepts (249-53).

64 Some of these ideas on this come to the fore much later in his co-authored work with film scholar Ed Tan on sentiment in film viewing. (See Tan and Frijda 1999).
that this is a primary source of literary emotions. However, I want to look at more than such phenomena. I want to see what effect other processes might have on such text-based events.

Ed Tan has argued that film viewers have goals. In his work *Emotion and the Structure of Narrative Film: Film as an Emotion Machine* he suggests that viewers (i) have expectations that concern envisioning a number of possible structures that can come about as a result of the ongoing narrative, (ii) continually test those structures, and (iii) hope to feel during that testing that progress is being made towards closure or a favoured closure. In Tan’s own words this is ‘a preferred final outcome’ (98). If film viewers have goals, which they clearly do, literary readers must have them too, and, as I suggest above, these start long before the reader engages with the text. Hogan (2003) hold an insightful dialogue of Tan’s work (149-50) and poses a probing question in an endnote to that discussion: “why do we formulate this ‘preferred final outcome’ then care so much about it when the events are fictional and we have no egocentric involvement in them” (223). My provisional answer to this would be that even though the events are fictive, our commitment as readers to become emoted by the chosen literary work of art most definitely makes literary reading an egocentric process from the level of the reader’s macro-goals. Hogan, however, is there before me:

If we add Tan’s account to Oatley’s we see that the audience member’s response to a narrative may appear to be a direct function of the protagonist’s goals. But it is in fact the reader’s formulation of a goal (the preferred final outcome), even though that is a goal for the characters rather than for the reader him/herself. Thus our emotional experience of a literary work is a function of junctural evaluation of narrative events in relation to our own goals – specifically our preferred final outcome, a goal that need not be the same as that of the protagonist (149).

Hogan adds that a reader’s emotion at such junctures need not coincide with that of the character, even when we share his/her goals. Several issues may have a bearing on this: not least the literary critical notion of dramatic irony, where, due to the elected mode of narrative presentation, the reader or viewer knows far more about the ensuing fate of the characters than the characters do themselves.

In the course of his 2003 work on *Cognitive Science, Literature and the Arts* Hogan (re)introduces a Medieval Sanskrit theory on art reception and emotion called *dhvani*, put forward by the philosopher Abhinavagupta. The general principle of classical Indian aesthetics is that all works of art communicate emotion through their *dhvani* or ‘suggestiveness’. Hogan continues:

*Dhvani* includes all the associations that cluster around anything that a reader encounters in a work of literature or a viewer encounters in a performance. It derives from individual words, patterns of imagery, scenes, characters, narrative sequences and so on. The suggestions themselves comprise not only other words, but a wide range of non-verbal associations (156).

In literary theoretical terms this is akin to Bakhtin’s notion of intertextuality, and in cognitive psychological terms it bears traces of Rumelhart’s theory of parallel-distributed processing. Abhinavagupta, Hogan informs us, wondered how all these associations can produce emotions in readers. His answer was that all experiences leave traces in the mind, and that these traces are encoded with the emotions that were felt at the time. The traces are then used to process and contextualise each new aesthetic experience. This is not necessarily a one-to-one mapping that leads to explicit recall: after all, we are talking about cognitive traces interacting with textual and contextual suggestiveness. Although particular suggestions can be understood as matching up with particular memory traces, suggestiveness can also connect to a memory in more implicit ways that does not lead to explicit conscious recall (156). Hogan equates these ‘intermediate

65 Hogan has explored this topic too in *The Mind and Its Stories*.
states of semi activation’ in cognitive terms as ‘priming’, namely, as I discussed earlier, an item in memory that is activated to a high degree but nonetheless is just below access (158). However, Hogan makes the modified claim as well “that relevant memories are continually primed in our experience of literature”, adding that “the suggestions of literary works keep the emotion-laden memories primed for long stretches of time. Thus their cumulative effect may be strong” (my emphasis, 158). In sum: “personal memories are crucial to our emotional response to literature” (158).

Hogan draws on Oatley’s four-part model of literary cognition: story, discourse, suggestion structure and realisation structure. In doing so he observes that the third of these is in fact dhvani and that the fourth, the realisation structure, i.e. ‘the story as we imagine it’, is “entirely personal to the reader and it is to a great extent the result of recruiting personal memories” (158). In other words Oatley’s fourth stage results from his third. So, details of textual entities prime certain emotive memories in a reader’s head. Hogan adds that, like the story itself, these memories involve “persons setting and events” (160). It seems clear then that in filling out the background knowledge while reading, it is these person-based and place-based affective memories that are continually primed, and hence it will be these that get launched into the meaning-making vortex first. This, indeed, is a conclusion that Hogan comes to later, when he says that not only does reading lead to the priming of such personal memories but also to their activation (162). He further points out the cyclical nature of this affective process:

As our emotional response to a work develops out of a particular set of primed personal memories, those memories begin to guide our realization or concretization of that work. As a result of this concretization, the memories themselves are reprimed and thus our emotional response is reinforced or enhanced (161).

He reinforces the emotive goals of the engaged reader as opposed to those of characters in the text when he summarises the whole process of affective reading:

Fragmentary memories complete or fill in our imagination of a work and simultaneously give rise to our emotional response. In keeping with our general tendency to explain emotions by reference to salient experiences, we attribute that emotional response to the events of the work, which are the objects of our attentional focus. This is in part a misattribution. But it is not entirely a misattribution for our imagination of these literary events incorporates elements from the actual, biographical source of our emotions (162).\(^{67}\)

Hogan shows us as well how Abhinavagupta too had a clear view on the relationship between emotions and reading literature; evaluating the Sanskrit philosopher’s work he writes: “literary emotions are the result of emotion-laden memories that have been triggered by literary events, characters and so on, but are not self-consciously recalled” (157). This, for him, is a ‘highly plausible account’ with ‘great explanatory potential’. I agree. Hogan himself adopts this idea in an earlier article and comes to the conclusion that dhvani is “all the elements of any memory system that receive activation as a result of the experience of the literary work” (157). A central idea in his theory is that episodic memory does not just record facts about emotion, but can give rise to emotions as well.\(^{68}\)

\(^{66}\) The term structure here is appropriate, as unlike everyday discourse and/or reading situations a literary text is patterned to produce specific effects. As to whether this patterning is a conscious or subconscious process on the part of the author is a topic that is not relevant for this particular discussion.

\(^{67}\) He later expands on this saying that it is the actual activation of emotional memories rather than their priming that is the most important source of literary emotion (183).

\(^{68}\) See Hogan 1996.
The work done on intense or heightened emotion will be particularly relevant for us. Intensity, it should be understood, is not a simple concept (Frijda 32). A key factor in emotive intensity is tension and the subsequent release of built up tensions. In discussing this, one can go back as far as Aristotle’s ideas on katharsis, which focused on drama: in effect, on narrative writing. Theatre goers, going back to the sixth century BC, were moved to empathise with the characters on the stage while at the same time reflecting on their own lives. This is the ‘fear’ and ‘pity’ that made up cathartic responses. Tensions and their release have remained an important subject area and have been debated ever since, for example in some seminal discussions in Freud’s work. One twentieth-century theory related to this, by Daniel E. Berlyne (1960; 1974), is interesting for my study, because, like Aristotle’s theory, his too is interested in charting intense emotive responses to art, including literature. His theory of aesthetic response, which is concerned with ‘hedonic value’, claims that a subject’s interest in an object will grow with increased complexity until it reaches an optimal level. This is known as the ‘arousal-boost’. After reaching a crescendo it will fall with increasing complexity. This is the ‘arousal jag’. The arousal boost-jag theory was expressed by means of a Wundt Curve by which the hedonic value/pleasure was represented by an inverted U curve while the arousal potential/complexity was expressed by a rising line. The notions of highly emoted tension, arousal and release were all at the core of this theory. Tension involves activation: the readiness to respond emotionally or attentionally (Frijda 51). Frijda suggests that the term ‘relax’ is perhaps appropriate to refer to the drop in heightened emotion described by Berlyne (51). Frijda further suggests that since long exposure to high levels of arousal is not pleasant there is a kind of drive to regain homeostasis. He calls this feeling pleasurable and seems to suggest that people might even seek thrills not necessarily to experience the assent, but rather the descent (346). This, in effect, is Berlyne’s arousal jag. Frijda adds that arousal is simultaneously both pleasant and unpleasant and that the question of which of the two dominates, and when, depends on the intensity of the arousal (346). However, he suggests too that being moved by aesthetic objects should not be seen in mere terms of ‘tension release’ but rather as “surrendering to something greater than oneself” (358).

Tension can be said to go hand in hand with anticipation, and both involve some sense of movement. Frijda states that anticipation intensifies emotional experience in that it considerably extends the time period over which a given event exerts emotional influence; the event casts its shadow … forward” (292). He adds that anticipation affects the response to the emotional event when it comes (293). For example, it permits preparatory actions like ‘relaxing and bracing’ and it gives one opportunity for ‘advance coding or recoding of events’. Similarly, Zull has recently argued that there is a neural basis for a strong connection between movement and happiness: “play, sex, dance, music, games, eating, talking and many other pleasures all involve movement” (61). He goes on to suggest that we get enjoyment not merely by anticipating movement but also by anticipating imagined movement. His key example is literature: “we see it in stories that lead our minds towards a goal. In fact, this is probably the most important thing that keeps us reading a good book or watching a movie. We want something to happen” (Zull 62).

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69 The meaning of katharsis has been much debated by philosophers, literary and drama scholars and psychologist alike. Nussbaum (1986), for example, has argued that it means ‘clarification’ in the sense of clearing away objects rather than the more traditional views like ‘purification’ or ‘cleansing’ (391).

70 Many studies have since sought to work systematically and empirically with Berlyne’s arousal jag theory, often with mixed results. As Frijda points out, aesthetic appreciation is particularly difficult to deal with (357).

71 In that same discussion he turns to another aspect of aesthetic emotion that he says “is distinctly of less cognitive nature” one that has a “relevance to desire, to join and to possess” (358). Further, the notion of ‘losing oneself’ is highlighted as an aspect of the aesthetic process (358).

72 It can be seen from an earlier quote in the previous chapter that Zull includes reading in this list (205).
Euphoric emotions are also something discussed by Hogan within the context of literary reading. He observes that “the effects of emotional intensity on the central executive are not merely continuous. They involve stages or thresholds” (171). The three stages are the orientation threshold, the expressive threshold and the control threshold. With regard to the first of these Hogan notes how this narrowing of attentional focus, once an emotion has passed this threshold, is what Bower and Forgas (2001) have referred to as ‘mood congruent processing’: a coming together of the relevant information with one’s ‘prevailing emotional state’. At this orientation stage there is still an aspect of volition on the part of the readers: they can restrain and alter the intensity of the emotion. The second stage, the expressive threshold, is registered as having been passed when one cannot control one’s expression of emotions any longer. Tears and laughter are common features at this stage, though a person is still able to suppress actional impulses. The third stage, the control threshold, is where we lose control, even over actional responses (172). In fear this would be akin to freezing rabbit-like in the headlights, while in joy this takes on the form of hedonistic states of euphoria. Such states can also be said to blend sometimes excessive joy with excessive sadness. This for me is reminiscent of ‘agreeable melancholy’, a term coined by the eighteenth-century philosopher David Hume, while working on emotive response to art objects:

Nothing is so improving to the temper as the study of the beauties either of poetry, eloquence, music or painting. They give a certain elegance of sentiment to which the rest of mankind are strangers. The emotions which they excite are soft and tender. They draw off the mind from the hurry of business and interest; cherish reflection; dispose to tranquility and produce an agreeable melancholy (27).53

Hogan ends his discussion by noting how “this distinction on thresholds has a considerable bearing on literary study” (172).74 It should further be noted that there is also emotion under the level of orientation, which we usually call moods or feelings. Hogan points out that such subordination level emotions do have a bearing on our experience of art (173). However, he then restricts this by saying that this can only occur in contexts where attentional focus in not required. So in Hogan’s view it would work with background music but probably not with literature, since literature would demand continuous rather than sporadic attention. In summing up his position on emotion and literature Hogan makes a number of important assertions, including that emotional memories are implicit and almost certainly play a major role in literary experience. He adds that their activation, rather than their priming, is the main source of literary emotion (183). We respond emotionally to literature because of three essential things: trigger perception, concrete imagination and emotional memory (185). A number of variables such as proximity, speed, vividness and expectedness will affect the intensity of emotive responses and thus our response to literature. He also draws some important intersubjective conclusions: although the particulars of individual memories will differ, many emotional memories share some common features (185).

To return now to my central discussion on the neurobiology of emotion in this section, emotive processing, like all processing, is known to be a cross-cortical affair. The sub-cortical limbic system, where much of the initial emotive activity takes place, is known too as the visceral brain – ‘visceral’ in the traditional sense of ‘relating to inner feelings’ rather than conscious reasoning. This general region contains the aforementioned amygdala, hippocampus and (anterior) thalamus. The latter area, we recall, is a brain structure through which visual information must travel before it arrives in the primary visual cortex. At a ‘lower’ level, the

53 From Hume’s short essay “Of the Delicacy of Taste and Passion” (1757).

74 One interesting methodological example that Hogan gives is in reader response experiments where young male subjects are likely to respond in a far more restricted and censored way than young female ones, who unlike males can empathise with both female and male characters. Males, it seems, primarily empathise with characters of their own sexual gender (172).
generation of emotions relies on neurotransmitters called endorphins, described earlier, which are of great importance for feeling and mood. They are essentially hormones secreted in the brain and the nervous system. Certain endorphins can be said to lead to pleasurable experiences and even states of euphoria, while others can have more elementary soothing effects. From a neurobiological perspective, emotions and emotion processes are dynamic and fluid. This has also been found to be the case with regard to studies on literary emotion. For example, in their psychological work on literary text processing de Vega and Diaz (1996) have suggested that “emotions are dynamic states”, adding “and so their mental representations should also be dynamic” (303).

Similarly, at a psychological level emotion is increasingly understood not as static, perennially and irrevocably subordinate to cognition, but rather as a dynamic, integrated aspect of cognition. Writing on the interaction between emotions and beliefs, Frijda, Manstead and Bem have claimed that “emotions can awaken, intrude into and shape beliefs, by creating them, amplifying them or altering them” (5). In this view, emotions are an integral and crucial part of beliefs, rather than merely being dependent on them. This is seemingly the opposite of what Lazarus and other cognitive appraisal theorists are saying. The crucial role that feelings can play in influencing beliefs, judgements and thoughts has been highlighted too by many other cognitive psychologists. For example, Herbert A. Simon first proposed back in the 1960s that emotions can alter processing priorities. He spoke too of ‘hot cognition’ rather than the somewhat cooler category of ‘cognitive emotion’. More recently, a whole host of psychologists have emphasised the role that emotions have on beliefs and judgements. For example, Clore and Gasper have done work that looked at how moods and emotions influence beliefs, and they concluded that “feelings arising from moods can become donors of credibility to any associated beliefs” (39). In other words, emotions guide attention and are often prior to beliefs. Similarly, Frijda and Mesquita state that “emotions influence beliefs” (45), adding that they can give rise to beliefs where none existed, change existing beliefs or enhance or decrease the strength with which a belief is held (45). They aptly speak of an “emotion-belief spiral” (49) and go on to turn the equation on its head by claiming that beliefs, rather than being a prerequisite for emotions, are actually a part of emotions (52). Indeed, they suggest that not only do emotions influence beliefs but they influence thinking in general (64). Similarly, Forgas (2000) has argued that “affective states can also influence the processing strategies people employ when constructing a belief” (130). He backs this up by describing how affect infuses beliefs (132-2).

We can conclude therefore that not all cognitive scientists believe in the primacy of beliefs and judgements, with emotions, feeling and moods always coming second. Oatley perhaps hits the nail on the head in Best Laid Schemes, his cognitive-psychological work on literary reading when he says emotions are not on the periphery of cognitive science but rather at the centre of human cognition (3). Emotions then are not merely the beneficiaries of beliefs; rather, in some cases, they can be their benefactors. I would argue that this is especially the case in situations where the embodied mind engages with an aesthetic object like a literary text. In this sense, therefore, beliefs, by their very nature, must almost always be to a significant extent emotive, because they are not grounded in a pure objective sense of world knowledge. Indeed,

75 In The Emotions Frijda had already argued that the appraisal process was ‘distinctly unconscious’ (464).

76 The notion of hot cognition (discussed more centrally in his 1983 work) is concerned with the idea that most people are able to think longer, harder and experience deeper impressions if information is emotive. Hot cognition mirrors in some ways what I call ‘affective cognition’.

77 In support of this claim they set out four features that suggest that thinking can be steered by emotion: ‘instrumentality’, ‘motivational force’, ‘control of the scope of thought’ and ‘motivated bias’ (64-8).

78 This is set out in his Affect Infusion Model (1995).
our beliefs are often outlandish for they are infused with our emotions, feelings, desires and moods. Such affective states are thus at the core of beliefs as Frijda and others have convincingly shown. Indeed, emotions can be said to be the very ebb and flow of higher cognitive processes, like beliefs and judgements.

2.7 Cognition and emotion: A recapitulation

From the works mentioned in this chapter, it is evident that advances in neurobiological imaging techniques have revealed the veritable multi-mapping, cross-neural nature of all kinds of cerebral processes. If the biology of thought, in the form of brain-based neurotransmitters flooding across synapses, has a confluvial, undulating, non-linear nature to it, as empirical neural testing seems to be suggesting with increasing force, then why should the abstraction of thought, in the form of mind-based cognitive appraisal models, not function in a similar fashion? Discussions in this chapter suggest that beliefs are part of inter-personal background knowledge. I believe that such subconscious mind-fed inputs are unavoidably drenched in fragmentary emotive remembrances of the self and of our loved ones. This is especially the case, I believe, when we bring beliefs to bear on objects and texts designed to aesthetically emote us, and especially the less directly visual objects like literature and music. It appears that beliefs by default carry strong emotive resonances. As Forgas rightly says, beliefs are “intensely personal, idiosyncratic creations” (108). An increasing number of cognitive neuroscientists are coming to appreciate the importance of emotion for our cognitive functioning. For example, Alice Isen writes that “cognition itself is profoundly affected by feelings, even mild feelings” (227); Mark Turner has stated that “feelings can affect intellect and vice versa” (44); while Antonio Damasio has asserted that the influence of feelings on cognition is immense” (160). Can all these cognitive scientists really be so wide of the mark?

If we were to continue to believe in rigid, reason-based appraisal processes, we would be supporting the traditional idea of a mechanical or computational view of mind and brain processes. As Damasio suggests, one must exert caution when using the ‘brain as computer’ metaphor since “the metaphor is inadequate” (321). Not only, however, is it figuratively inadequate, but recent neuroscientific research has started to show how flawed it is in literal terms too. Spivey, Grosjean and Knoblich, for example, have shown in their experiments that not just spoken language, which was the focus of their research, but also many cognitive and perceptual processes involve continuous uptake of sensory input, leading to dynamic competition between simultaneously active representations. In other words, processing in the brain do not work computer-like in distinct stages, rather the brain is continually awash with processing activities. The result of this is that sensory input is continually cascading back and forth in the mind. This idea of ebbing and flowing is echoed by neuroscientist Zull: “many, if not most, pathways of signalling in the brain include a combination of neurons that send signals in one direction and neurons that send signals in the other direction”(193). This general position was observable as well in my earlier discussion of how the amygdala continuously sends and receives information. However, perhaps the clearest description of the fluvial processes of the mind is given by Stephen M. Kosslyn and Olivier Koenig. These authors say towards the end of their influential work on ‘the new cognitive neuroscience’ entitled The Wet Mind (1995) that if they were to be given the chance to revise their work they would adopt a slightly different approach to thinking and neural computation. Instead, they would choose “a hydraulic metaphor”, as this metaphor “stresses the complex, interactive nature of the brain’s computation, and it encourages us to think about how emotion and motivation can alter information processing” (447-8):

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79 As Oatley and Jenkins suggest, judgements combine what we know with how we feel (278).

80 This I hope to show in the forthcoming chapters.
Imagine an above ground swimming pool with a hole in the wall just at water level; if the water laps against the sides, a series of pulses of water slosh through the hole. This sequence of sloshes is the output. Also imagine rocks, of different sizes and shapes, dropping into the pool and causing patterns of waves to spread. The rocks correspond to the input from the senses, and piles of rocks on the bottom correspond to memories; it is clear that the precise pattern of ripples will change as the rocks begin to alter the topography of the bottom. When ripples are modulated by the rocks on the bottom and bounce off the walls, complex patterns of interaction will develop. Indeed, this complexity will be exaggerated when rocks are dropping in multiple places, corresponding to input in multiple sensory modalities. Places where wavelets meet and interact may correspond to the functional subsystems we have proposed here (and to Damasio’s “convergence zones”) (448).

Here, mind and brain processes are expressed as wave interaction. Together with other views, it points forward to my notion of oceanic cognitive processes, to be discussed later. Such views can no longer be seen as outlandish or fanciful; rather they are rich and, more importantly, close to describing in actual terms, as well as metaphorical ones, how the mind and brain are now thought to function.

2.8 Conclusion
This second introductory chapter has discussed the nature of perception, cognition and emotion, and in doing so has helped to set the scene for how certain aspects of those concepts might play a role in literary reading. One thing has remained prominent as it did in the previous chapter, namely the idea that the neural, cognitive and especially emotive processes that the literary reading mind undergoes must be dynamic and fluvial. As the neurobiologist Susan Greenfield says “if emotions are with us all the time, ebbing and flowing and meshing with more logical thought processes, then we cannot expect to ascribe them to a confined corner of the brain” (my emphasis 121). It is here in this chapter that my own thoughts on affective and oceanic cognition have started to take form. They will return in later analyses. The next chapter will continue in the vein of the first two. However, it will also start to move from essentially scene setting to concentrate more on the main object of my study, namely, literary reading processes. Continuing with the concept of perception, it will deal with a powerful mind-fed component of any act of literary reading, namely, the nature of mental imagery that is induced while reading literature.