or her survival depends on this ability. The colour of berries may determine whether they are poisonous or good to eat. The visual system must "deduce" the spectral composition of the lighting and subtract this from the reflected light to allow us to "see" the real colour of the berries.

Consider the palaeolithic hunter aiming his spear at an antelope. The light may be poor and the image on the retina hazy or too brief for detailed processing. The animal will be camouflaged and it may be partly concealed behind a bush. According to a theory I have documented elsewhere (Fish 1996), the visual system handles such incomplete and confused images in two stages. First, it must identify the animal from the bits that are visible by referring to long-term memory (recognition by parts). Second, it must use a stored representation to generate internally a spatial depiction of the animal. The mental image is then rotated and scaled to match the image from the retina so that it can be superimposed in spatial register with its neural representation to create a hybrid image partly from memory and partly from the eyes. Thus the hunter instinctively uses unconscious knowledge to guide the spear. I speculate that there must be twinned images from memory and the eyes which may be interleaved with spatially corresponding parts, much like the twinned images from the two eyes that are interleaved and fused, if they are compatible, for binocular vision. There must then be a spatial comparison process and, as with retinal rivalry, a gate that allows a hybrid image to be constructed if the two images match, but which allows only the stronger of the two images to become conscious if the match fails. This account of percepts as hybrid images is controversial, but the evidence that memory can influence the perception of impoverished stimuli is not. In an early experiment that fits the gating mechanism proposed above, Bruner and Postman (1949) asked subjects to identify ordinary but hand-painted playing cards exposed for a fraction of a second. Unknown to the subjects a few of the cards had the incorrect colour for their suit, black diamonds or hearts, red spades or clubs. The authors recorded four types of response to the incongruous cards. The first they call a "dominance" reaction in which the subject reports with assurance that a red six of spades is either a normal (black) six of spades or is the six of hearts, depending on whether the colour or shape is dominant. Another type of response they call "disruption" in which the subject fails to resolve the stimulus and does not know what it is (although at the same exposure time he *can* identify normal cards). In a third type of response the incongruity is "recognized." However, in a fourth type of response, there is a "compromise." For example, a subject may report that (a) the red six of spades is either the purple six of spades or the purple six of hearts; (b) the black four of hearts is reported as a "greyish" four of spades or (c) the red six of clubs is seen as "the six of clubs illuminated by red light". Analogous experiments have demonstrated the influence of memory on the perception of colours (e.g., Bruner et al. 1951). There are other examples in the literature where an indeterminate stimulus is completed with information from memory (e.g., Segal 1972; Segal and Nathan 1964; Farah 1985).

Experimental evidence shows that the ability to generate images from memory of absent objects shares many of the properties and format of perception (Finke 1980, 1985; Kosslyn 1980, 1994). It is clear that the resources that our brains provide us with to imagine non-existent objects are "borrowed" from and shared with the neural machinery that evolved for perception (Kosslyn and Sussman 1994). It has frequently been observed that

damage to a specialized component of the visual cortex for colour or shape, for example, produces a corresponding inability in the power to imagine (Farah 1985, 1988). Even more striking is the evidence from brain-imaging studies. Depending on the nature of the imagery task, it has been shown that carefully matched imagery and perception tasks cause differential regional blood flow in the same parts of the cortex (Kosslyn et al. 1997). A spatial imagery task activates the same region in the parietal cortex as a corresponding spatial perception task. Interestingly, it is not only visual cortex that is shared with imagery. When a subject mentally rotates one of two shapes into congruence with the other in order to make a comparison, the same region of the motor planning cortex is activated as when we move our hands. When a joystick is rotated manually simultaneously with the mental task, it speeds up the rate of mental shape rotation if it is in the same direction and slows it down if it is in the contra-direction (Wexler et al. 1998). Kosslyn and his colleagues have found that, with detailed imagery tasks, even the primary visual cortex, the very earliest part of the visual pathway to map the information from the retina, is active (Kosslyn et al. 1999).

Thus the capacity to generate, inspect and manipulate mental images of imaginary objects is an incomplete time-lagged adaptation of our visual systems and our movement planning systems. Because of the way our brains work, untidy or incomplete visual stimuli can both elicit and support mental imagery. Without such support, visual imagery is hazy and fades quickly. It is as if mental images were stored with perceptual parts "looking for" incoming images to repair. As with words in the phonological loop, images in visuo-spatial working memory need constant refreshment (Phillips and Christie 1977). As Kosslyn (1994) has suggested, the fast-fade characteristics of the shared "visual buffer" may be an adaptation to the fact that our eyes move in short "saccadic" jumps every fifth of a second. Passing images in the buffer must be quickly erasable to make way for new ones. However, this property is not well adapted to slow reflection about imagined objects. It needs cultural support.

Between 35,000 and 10,000 BP our hunter-gathering ancestors produced, in uninhabited inaccessible caves, beautifully observed paintings and sculptures of animals that included perspective and the representation of movement. The shaman theory of Clottes and Lewis-Williams (1996), although not accepted by all experts, is, to my mind, the only convincing explanation of the properties and circumstances of upper palaeolithic cave paintings. Shamans are spiritual leaders and healers who believe they can communicate with, and even unite with, the spirits of certain animals and access their spiritual power. Shamans have been known since Marco Polo and are found wherever there are, or have been, hunter-gathering people, in North and South America, in Siberia and South Africa where David Lewis-Williams has studied the cave art of the San people of the Kalahari over many years. To the San shamans, the cave walls were never regarded as a passive medium, but were thought to be a gateway to the underworld where faint images of the animal spirits could already be seen. Trained to put themselves into a hallucinatory trance state, shamans believe that the animal spirits enter their bodies and control it as they engrave or paint their images. The elderly daughter of a San shaman told Lewis-Williams that her father, by placing his hands on the cave wall next to the animal image, could extract power from the spirit or heal a sickness. Stencilled images of hands are often found associated with both modern and