A peculiar Optical Phenomenon
This issue of *Perception* is devoted to the motion aftereffect (MAE) that is often referred to as the waterfall illusion, following its first reported observation at the Falls of Foyers in Scotland (see figure 1). Continuous motion observed for a minute or two leads to a compelling and relatively long-lasting impression of oppositely directed motion in stationary objects. The aftereffect gradually declines, but is robust enough to survive the vagaries of viewing distance, illumination, fixation, and angular size.

Figure 1. A photograph of the Falls of Foyers, Inverness-shire, Scotland, after which the waterfall illusion was named. This is a noted beauty spot which was celebrated in verse by Robert Burns and William Topaz McGonagall. The flow over the waterfall is nowadays much reduced from that witnessed by Addams, as the result of a hydroelectric installation above the Falls.
It can be produced by linear, radial, and circular motion. The issue had its origin in a conference on the waterfall illusion held in Foyers between 23 and 25 August 1993. It was in 1834 that Robert Addams was inspired by the Falls of Foyers to write his evocative account of the motion after-effect generated in the surrounding rocks after observation of the falling water. The original paper is reproduced in figure 2. Few reports of visual phenomena have achieved such high standards of brevity, clarity, and elegance of expression.

Mr. Addams on a peculiar Optical Phenomenon. 373

Three factors, viz. (a) the experience of movement proper, similar to the after-effect, and (b) the change of position in space ... The after-effect is different from the experience of seeing an objective movement, in that the latter contains two components (a) and (b), as described above, whereas the after-effect contains (a) alone” (pages 108-109).

The study of the perceptual consequences of prolonged stimulation has a long history, but prior to the early nineteenth century it was confined principally to after-images and colour phenomena. The MAE represents the application of the adaptation paradigm to spatial vision. It elicited great interest in the latter half of the nineteenth century, and this first phase of research was reviewed by Wohlgemuth (1911). For reasons that are difficult to divine, Wohlgemuth misspelled Addams’s name as Adams, and his error has frequently been repeated. Wohlgemuth did draw attention to a paradoxical feature of MAEs: “I hold that in an objective movement we have two factors, viz. (a) the experience of movement proper, similar to the after-effect, and (b) the change of position in space... The after-effect is different from the experience of seeing an objective movement, in that the latter contains two components (a) and (b), as described above, whereas the after-effect contains (a) alone” (pages 108-109).
This characteristic of MAEs has created problems with regard to its measurement, since it cannot be readily cancelled by real motion. On the other hand, the possibility exists that it might provide a means of measuring a pure motion system in vision. Indeed, this was appreciated early on by Bowditch and Hall (1881): “We cannot resist raising the question whether we may not be here very near the * quale* of real, pure sensation” (pages 300–301).

Despite the promise offered by the phenomenon relatively little experimental attention was paid to it in the first half of the twentieth century. Interest did return in midcentury when the spiral version of the MAE was applied to examining individual differences, arousal, and the effects of brain injury. This phase was surveyed by Holland (1965) who displayed his own ambivalence towards MAEs thus: “If... the illusion represents a response of the organism in its attempt to cope with its environment it will always find psychologists willing and eager to accept the challenge of its unbearable ambiguity” (page xi). In the last three decades this challenge has been eagerly accepted. Many of those who have sought to interpret the MAE in terms of the putative underlying processes responsible for it see the phenomenon as a bridge between neurophysiology and perception. The adaptation paradigm has taken on a more precise focus—it is often argued that if a stimulus feature can be adapted, then there is likely to be a physiological detector for it: stimulation adequate to elicit the aftereffect should also lead to measurable changes in the response of neural systems concerned with the processing of motion information. This has been a primary motivation for perceptual and neurophysiological studies, and it remains an important element in current research. It is clear from recent work, however, that there is no simple or direct correlation between the measured responses of cellular systems and the psychophysical characteristics of the MAE. Nonetheless, this approach informs most of the recent work on MAEs.

A representative sample of contemporary research is presented in this issue. All but one of the papers were contributed by those who attended the conference. While the papers are not the same as those delivered at Foyers, they are based on them and have benefitted from the discussions that ensued. The papers have been ordered to give some degree of development and coherence to the issue. The first paper (Wade) examines the early history of the MAE, and provides a bibliography of papers concerned with the phenomenon throughout the last three decades. Broerse et al present a translation of the first paper, published in 1870, to be concerned with interocular transfer of the MAE. Harris reviews evidence linking pharmacological factors to the strength of the MAE in schizophrenics. The relationship between MAEs and visual evoked potentials is investigated in the paper by Wist et al. The role of extrastriate processes is indirectly assessed by Wenderoth et al with the aid of plaid patterns. A novel computer-generated stimulus involving transparent motion is examined in three papers from the Utrecht group (van de Grind et al, Verstraten et al, and van Wezel et al). Random dot kinematograms are used to investigate interocular transfer (Steiner et al), and the effects of displacement size and frame duration (Raymond). Ledgeway and Smith compare the duration of the MAE following adaptation to first- and second-order motion. Troscianko assesses the role of colour in the MAE, an issue that has been relatively neglected. The MAE shows storage, and the dependence of this on intervening stimulation is experimentally appraised by Thompson and Wright. The capacity of the MAE to support depth from motion parallax is analysed by Ono and Ujike. Ehrenstein reports an analogue of the visual MAE in the auditory domain. Finally, Swanston surveys evidence concerning the possible levels at which MAEs could be expressed. It is evident that the MAE is a significant source of insights into the nature of perceptual processes, and that it is as yet by no means fully understood. We hope that the next 160 years will be as
productive as the last. All the authors of papers met very tight deadlines for submission and revision of manuscripts. We are very grateful to all the contributors for their enthusiasm and commitment to this project. Similarly, the assistance of the referees is gratefully acknowledged; we were greatly assisted by their prompt responses.

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