ENGLISH SUMMARY
When scanning the scene in front of you or when reading these words right now, you are not able to perceive the whole scene or page at once. Rather there is only a small area of the scene that you can see sharply. In order to perceive the whole scene at high resolution, your eyes make many jumps (saccades) from one area of the scene to another and stop several times (fixations), moving very quickly between each stop.

Saccades, therefore, play a very important role, as they bring the eyes quickly to the next area of interest, so that it can be seen at high resolution during the fixation. On the other hand, during saccades the eyes move so fast that it is hard to describe the visual content of the scene. Despite this, we are still able to perceive visual events that occur while our eyes are moving fast: stimuli presented briefly during saccades can be perceived. However, the location of these stimuli is systematically misjudged towards the endpoint of the saccade, a phenomenon called perisaccadic compression.

The cause of the compression has been debated. Some attribute it to a mechanism for remapping the visual scene across saccades (Ross et al., 2001), whereas others attribute it to a combination of temporal uncertainty about the time of the briefly presented stimulus with a bias to believe that what one has seen was where one was looking (Maij et al., 2011a). The aim of the present thesis was to shed more light on the cause of perisaccadic compression. In order to do so, we tried to distinguish the roles of various aspects that are involved in perisaccadic compression and generally co-vary.

In Chapter 2, we addressed the co-variation between the target position and the actual endpoint of the saccade. To distinguish between the two, we made use of the Müller-Lyer illusion that influences the perceived distance to the target of the saccade and thus the saccade endpoint (Figure 1.2) without affecting the perceived position of the
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saccade target (the endpoint of the shaft). Our results showed that the Müller-Lyer illusion affected the amplitude of the saccade. It also affected the pattern of compression during saccades. This is clear evidence that compression during saccades is related to the eye orientation at the end of the saccade and not to the position of the saccade target within the image.

In Chapter 3, we examined whether compression is a special characteristic of the retinal resolution being so much higher where one fixates than elsewhere, or whether it is related to the position at which one fixates, no matter the retinal resolution. Normally, the retinal resolution is higher where we fixate than elsewhere. However, Macular Degeneration (MD) damages the part of the retina with the highest resolution (the fovea) and many people with MD adopt a new retinal locus for fixation, called the preferred retinal locus (PRL; Figure 1.3). The PRL in people with MD is similar to the fovea of people with normal vision in terms of defining where one is looking. It is, though, quite different in terms of variations in retinal resolution. We found that a person with MD, who has a loss of foveal vision, showed a clear compression towards her PRL. This is evidence that perisaccadic compression is related to the position that is fixated after the saccade, no matter its retinal resolution.

In Chapter 4, we attempted to dissociate the roles of gaze and eye displacement on perisaccadic compression. In most studies on perisaccadic compression the head was static, so the amplitude of the saccade was equal to the gaze change that was achieved by rotating the eyes in the head. So, it was unclear whether it was the parameters of the gaze shift that were positively correlated with the magnitude of compression or the parameters of the eye-in-head rotation. To distinguish between the two, we asked participants to shift
Where?

can move their gaze between two positions, either with or without moving their head, and to localize a flash presented around the time of the saccade (Figure 1.4). We found less compression when the head contributed to the change in gaze, and a positive correlation between the magnitude of compression and the parameters of the rotation of the eyes relative to the head.

Finally, in *Chapter 5*, we examined whether spatial localization of a flash presented around the time of a saccade involves judging the time of the flash. We hypothesized that if errors in judging the time of the flash are responsible for the reported spatial compression of flashes presented around the time of saccades, we should be able to manipulate the pattern of compression by altering the perceived time of the flash. To dissociate between *misjudging space* and *misjudging time*, we presented a relevant red flash within a short rapid sequence of irrelevant black flashes and asked participants to localize it (Figure 1.5). The relevant flash was always at the same spatial location but in different temporal order (second or fourth) in the sequence of five bars. We found that when the relevant flash was presented second in the sequence, it was judged to be further in the direction of the saccade than when it was presented fourth in the sequence. This is evidence that the spatial localization of flashed stimuli involves judging the eye orientation at the estimated time of the flash.

Altogether the results of the present thesis show that the critical aspects in each of these studies are the aspects that one would expect to be critical if perisaccadic compression is caused by temporal uncertainty about the time of the flash with a bias to believe that what one has seen was where one was looking.
Summary