Chapter 20
Diversity and Types of Eye Tracking Applications

A wide variety of eye tracking applications exists, which can broadly be described within two categories, termed here as *diagnostic* or *interactive*. In its diagnostic role, the eye tracker provides objective and quantitative evidence of the user's visual and (overt) attentional processes. As an interface modality, the eye tracker serves as a powerful input device that can be utilized by a host of visually mediated applications.

In general, in their diagnostic capacity, eye movements are simply recorded to ascertain the user's attentional patterns over a given stimulus. Diagnostic applications are distinguished by the unobtrusive use of the eye tracking device. In some cases, it may even be desirable to disguise the eye tracker so that potential subjects are not aware of its presence. Furthermore, the stimulus being displayed may not need to change or react to the viewer's gaze. In this scenario, the eye tracker is simply used to record eye movements for posttrial, off-line assessment of the viewer's gaze during the experiment. In this way, eye movement data may be used to objectively corroborate the viewer's point of regard, or overt locus of attention. For example, studies that test the appearance of some aspect of a display, say the location of an advertisement banner on a Web page, may be bolstered by objective evidence of the user's gaze falling on (or missing) the banner under consideration. Typical statistical measurements may include the number of fixations counted over the banner during a five-minute "Web browsing" session. Diagnostic eye tracking techniques are applicable (but not restricted) to the fields of psychology (and psychophysics), marketing/advertising, and human factors and ergonomics.

Equipped with an eye tracker as an input device, an interactive system is expected to respond to, or interact with the user. Interactive applications are therefore expected to respond to the user's gaze in some manner. Such interactive systems may be classified by two application subtypes: selective and gaze-contingent. The latter can be further delineated in terms of display processing, as shown in the hierarchy in Fig. 20.1. The archetypical interactive eye tracking application is one where the user's gaze is used as a pointing device. This type of ocular interaction can be considered but one of a set of multimodal input strategies from the system's point of

A.T. Duchowski, *Eye Tracking Methodology*, DOI 10.1007/978-3-319-57883-5_20

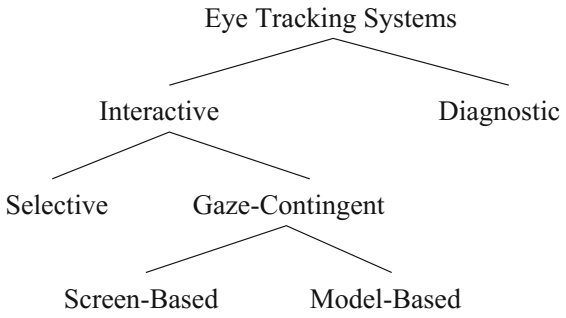

Fig. 20.1 Hierarchy of eye tracking applications

view (Hutchinson 1993; Nielsen 1993; Schroeder 1993a, b). An example of a system relying solely on gaze as input has been shown to be an important communication tool for quadriplegics, where the eyes are used for positioning a cursor over an oversized projected keyboard. Using gaze to aid communication has also been explored in multiparty computer-supported collaborative work systems (Vertegaal 1999). Besides being used as a pointing device, knowledge of the user's gaze may be utilized to alter the display for speed-up purposes, as may be required in the rendering of complex virtual environments (McCormick et al. 1996). Interactive eye tracking techniques are applicable (but not restricted) to the fields of human–computer interaction, visual displays, and computer graphics.

20.1 Summary and Further Reading

A wide variety of (interdisciplinary) eye tracking applications has been and is currently being developed. The examples described and shown here by no means constitute a complete survey of the field, but it is hoped that they provide sufficient motivation to spur further interest in this fascinating area.