Chapter 18
A Client–Focused Methodology for Gaze Control Assessment, Implementation and Evaluation

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ABSTRACT
This chapter addresses challenges involved when working with people whose involuntary eye or head movements make it difficult for a gaze-controlled computer to accurately interpret their eye movements. The chapter introduces the methodology we adopted for the ACE Centre user trials, which we have described as the ‘KEE’ approach to trialling and implementing gaze control technology: Knowledge-based, End-user focused, and Evolutionary. In our experience, this approach has been found to enhance the chances of success for even the most complex end-users.

INTRODUCTION
During the COGAIN project, the ACE Centre has aimed to address the access needs of people who have the most complex and severe disabilities. Some individuals have experienced nystagmus and/ or the ability to move their eyes in only a horizontal or vertical plane; whilst others have experienced Athetoid Cerebral Palsy, causing severe involuntary movement. In these particular cases, it has been quite a challenge for gaze control systems to accurately interpret their eye movements. The ACE Centre has asserted that, by modifying gaze control systems in order to meet the needs of those who have the most severe and complex difficulties, it should be possible to meet the needs of a far wider range of people.

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This chapter discusses the methodology that has been adopted for the COGAIN end-user trials, which can be summarised as the ‘KEE’ approach (Donegan & Oosthuizen, 2006). In our experience, adopting the KEE methodology increases the chances of success for even the most severely disabled participants.

THE KEE METHODOLOGY

The ‘KEE’ approach incorporates a combination of methods:

- **Case Study:** In case studies, the emphasis is placed on exploration and description. Our own approach has been to examine the interplay of as many variables as possible, in order to build up as complete an understanding of the individual’s needs, and the means to meet these needs. A process by Geertz (1973), known as ‘thick description’, is one in which the researcher not only aims to explain the entity under investigation, but its context as well, such as: the specific circumstances; the specific characteristics; and the nature of the community in which the research is based. During a gaze control assessment, factors identified include the purpose of using the gaze control system i.e., for social communication and environmental control, etc; and the wider social and physical context of the user.

  For our own investigations, there were several advantages in selecting a case-study-based approach, over other methods. Through adopting a case-study-based approach, researchers are able to “generate their own analysis of the problems under consideration, develop their own solutions and practically apply their own theoretical knowledge to these problems” (Boyce, 1993).

  Often, for those people who have physical disabilities, using a gaze control system is a simple, speedy and straightforward process. For example, for the well-motivated and literate person, who has good head control and visual acuity, they are generally able to ‘eye type’ on more or less any of the currently commercially available systems in a matter of minutes. However, for others, the process is not so straightforward. This is true for individuals who have profound and multiple learning difficulties; visual difficulties; and/or severe involuntary movement. This is why a flexible case-study-based approach was adopted. With this approach, researchers have... “the power to analyse and to master a tangled circumstance by identifying and delineating important factors; the ability to utilise ideas, to test them against facts and to throw them into fresh combinations...” (Merseth, 1991)

- **Grounded Theory:** Primarily qualitative research methods were applied. These methods owe a great deal to ‘Participatory Design’; the ‘Grounded Theory’ approach of Glaser and Strauss (1967); and ‘Comparative Analysis’.

  The Comparative Analysis of cases takes us beyond the notion of the case study being illustrative. When data from similar situations are compared, common themes and patterns can be elicited, hypotheses generated and theory developed. The examination of themes is important in all case studies, but particularly important if the research demands Comparative Analysis. (Edwards and Talbot, 1994, p. 45)

  Over time, by comparing the results of several individual case studies we found that, themes emerged which, if applied, could enhance the chances of success for both the initial assessment and subsequent implementation.

- **Participatory Design:** As well as understanding the individual’s access difficulties; it was important to identify the activities