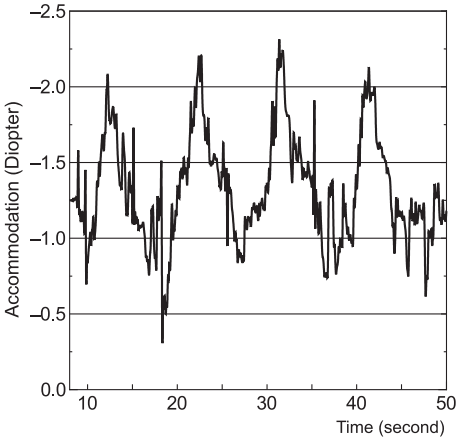
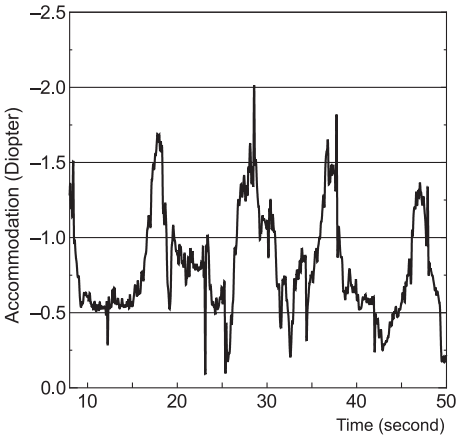
Table 1. Subject's condition.

| | Age | Sex | Condition | Experiment |
|---|---|---|---|---|
| Subject A | 21 y.o. | Male | Normal vision | 1 |
| Subject B | 21 y.o. | Male | Normal vision | 1 |
| Subject C | 19 y.o. | Male | Normal vision | 2 |
| Subject D | 20 y.o. | Male | Normal vision | 2 |
| Subject E | 20 y.o. | Male | Normal vision | 3 |
| Subject F | 36 y.o. | Male | Normal vision | 3 |
| Subject G | 21 y.o. | Male | Normal vision | 4 |
| Subject H | 22 y.o. | Female | Normal vision | 4 |




(a) Subject A (21 y.o. male)




(b) Subject B (21 y.o. male)

Fig. 4. Accommodative change in subjects viewing a moving stereoscopic image (Experiment 1). X-axis shows time: 0–50 sec, Y-axis shows diopter: 0–2.5 diopter.

the stereoscopic image was measured in both the 2-D and stereoscopic display mode. The subjects were instructed to gaze at the center of the sphere, and the total gazing time was 60 seconds. Subjectively, all subjects obtained full stereoscopic viewing. Accommodation of the right eye was measured and recorded while subjects viewed the stereoscopic image with both eyes.

### 3.3 Results

**Experiment 1. Measurement of accommodation while the subjects gazed at the stereoscopic image on LCD**

When the subject's viewed the target "moving" progressively closer, the right eye of both subjects was accommodated to the near point. Figure 4(a) shows the objective changes in accommodation of subject A (21 years old), and Fig. 4(b) shows the objective changes in accommodation of subject B (21 years old). When subject B viewed the progressively receding target, his accommodation was about 0.5 D at the virtual furthest point, which was 2 m beyond the actual screen. Thus, they were confirmed to have an accommodative focus with a visual distance of approximately 2 m when they gazed at the stereoscopic, virtually distant images.

When subject A recognized the target that appeared at a near point, his eyes were accommodated about −2.2 D. This suggests that accommodation range comes at about 45 cm from subjects' eyes. In this experiment, the display was set at a distance of 57 cm from the subject's eyes and the stereoscopic image appeared to "fly" 20 cm out from screen. However, it has been shown experimentally that young people have an accommodation range of 0.3 D or 0.5 D from the actual distance. In fact, the accommodative near point of one subject was 2.7 D, which is 37 cm in front of the subject's eyes. With this level of accommodation, the ciliary muscle is stressed. When subject B recognized the target as being at the near point, his eyes were accommodated about −2 D.

This suggests that the accommodation range came at about 50 cm from the subjects' eyes. However, considering the accommodation range of some 0.3 D or 0.5 D, the accommodative near point of one subject was −2.5 D, and the subjective near point of subject B was about −2.5 D, or about 40 cm in front of the eyes. With this level of accommodation, the ciliary muscle is stressed. Thus, the ciliary muscle is repeatedly strained and relaxed while a subject views a moving target.

**Experiment 2. Measurement of accommodation while subjects gazed at the stereoscopic image on LCD and CRT**

In this experiment, the subjects' accommodative amplitudes changed when the target moved from the near to far point on the CRT (Figs. 5(a) and (c)). In subject C, the accommodative near point approached the angle of convergence. In subject D, it was larger than the angle of conver-