Table 2. Experimental environment.

System		Liquid crystal shutter	Circular polarizing filter
Brightness of spherical object (cd/m^2)	Far	3.6	34.5
	Near	3.0	31.1
Illuminance (lx)	Far	126	129
	Near	〃	〃
Size of spherical object (deg)	Far	0.20	0.17
	Near	7.70	6.44

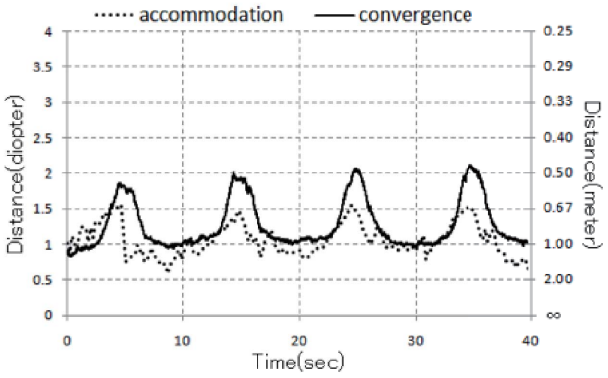

Fig. 8. Circular polarizing filter system (Subject B).

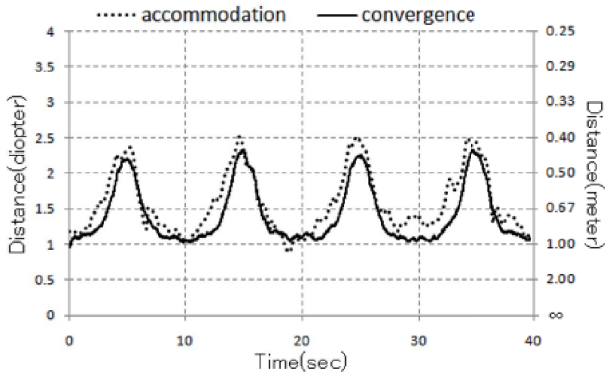

Fig. 10. 3D vision.

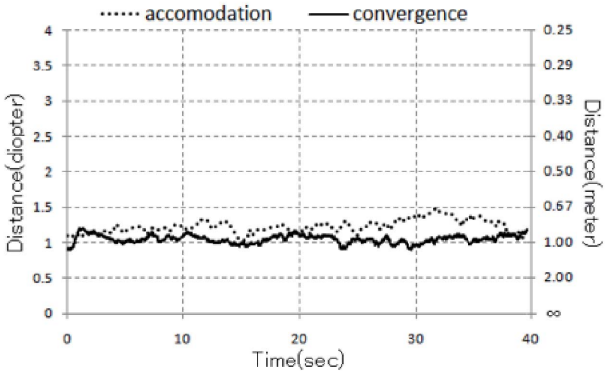

Fig. 9. 2D vision.

Table 3. Mean value of accommodation and convergence.

	Accommodation	Convergence	Difference
2D	0.96 D	0.96 D	0 D
	(104.2 cm)	(104.2 cm)	(0 cm)
3D	1.29 D	1.32 D	0.03 D
	(77.5 cm)	(75.8 cm)	(1.7 cm)

3. Results

The measurements for the 6 subjects showed roughly similar results. For 3D vision, results for Subjects A and B are shown in Figs. 5–8 as examples. When Subject A (23 years old, male, soft contact lenses) viewed the 3D image with the liquid crystal shutter system (Fig. 5), accommodation changed between about 1.0 Diopter (100 cm) and 2.5 Diopters (40 cm), while convergence changed between about 1.0 Diopter (100 cm) and 2.7 Diopters (37 cm). The changes in the respective diopter values have almost the same amplitude and are in phase, fluctuating synchronously with a cycle of 10 seconds corresponding to that of the 3D image movement. In the same subject but with the circular polarizing filter system (Fig. 6), accommodation changed between about 0.8 Diopters (125 cm) and 2.3 Diopters (43 cm) while convergence changed between about 1.0 Diopter (100 cm) and 2.3 Diopters (43 cm). The changes in the respective diopter values have almost the same amplitude and are in phase, fluctuating synchronously with a cycle of 10 seconds corresponding to that of the 3D image movement.

Similarly, when Subject B (29 years old, male, soft contact lenses) viewed the 3D image with the liquid crystal shutter system (Fig. 7), both accommodation and convergence changed in almost the same way between about 0.8 Diopters (125 cm) and 2.0 Diopters (50 cm). The changes in the respective diopter values have almost the same amplitude and are in phase, fluctuating synchronously with a cycle of 10 seconds corresponding to that of the 3D image movement. In the same subject but with the circular polarizing filter system (Fig. 8), accommodation changed between about 0.7 Diopters (143 cm) and 1.6 Diopters (63 cm), while convergence changed between about 1.0 Diopter (100 cm) and 2.0 Diopters (50 cm). The changes in the respective diopter values are a little different in amplitude, but are in phase, fluctuating synchronously with a cycle of 10 seconds corresponding to that of the 3D image movement.

For 2D vision, the results for Subject A are shown in Figs. 9 and 10 as an example. When he viewed the 3D image with the liquid shutter system, his accommodation and convergence changed between about 1.0 Diopter (100 cm) and