CHAPTER 6

CONCLUSION

In this concluding chapter the results from the experiments reported in the previous chapters are reviewed along with their limitations. Also suggestions are made for possible further studies on alpha bio-feedback in the future.

6.1 REVIEW OF EXPERIMENTAL RESULTS

The experimental studies reported in this thesis have been specifically directed:

i) To identify the best possible location on the scalp to place EEG electrode so as to pickup the strongest possible alpha EEG signal;

ii) To study the effect of feeding back the different split bands of alpha signal;

and iii) To study the effect of phase shift in alpha bio-feedback.

Further, based on the above experimental results, a system model has been proposed based on modulation theory and control system concept. We shall now review the above results.

6.1.1 Result of optimum electrode location experiments

Earlier studies by others have indicated that the alpha signal is strong in the occipital region of the scalp. Six standard locations
namely P3-O1, P4-O2, T5-A1, T6-A2, O1-A1 and O2-A2 along with two newly proposed locations namely (P3-O1)/2-A1 and (P4-O2)/2-A2 were chosen and alpha count experiments were conducted using a microprocessor system. The statistical ‘t’ test was applied to the alpha counts as listed in table 2.5 and it was found out that the electrode location T5-A1 results in maximum signal pickup.

6.1.2 Identification of most valuable alpha band in bio-feedback

Having thus identified the ideal electrode location for maximum signal, further experiments were conducted on alpha bio-feedback using the various alpha band signals filtered through appropriate filters. The results indicates that the alpha band II (9 Hz - 11 Hz) results in maximum percentage power. This fact and other related findings are reported in section 3.4.

6.1.3 Results of phase shift studies on alpha bio-feedback

Basically EEG signals are electrical signals. It was suspected that a phase shift introduced in the alpha bio-feedback may have some effects on the result. With this aim a set of experiments were conducted as reported in chapter 4. From the recorded observations it was obvious that the feedback had definite effect on the spectral power content. A careful analysis of the results indicate that the spectral power content in the alpha signal peaks around a phase shift of 115°.

6.2 MODELLING OF ALPHA BIO-FEEDBACK SYSTEM

Having examined the optimum electrode location, the most effective alpha band for bio-feedback and the effect of phase shift on alpha bio-feedback, it was considered as appropriate to investigate the possibilities of a system model for alpha bio-feedback. As reported in chapter 5 a
theoretical model based on the concepts of communication theory and control system approach was proposed. Beginning with an AM/FM alpha EEG source proposed by John G. Okyere (1986), an additional amplitude modulation term controlled by the phase shift was introduced in the proposed model. The new modulation term is approximated by a power series and the coefficients have been evaluated using the experimental results reported in chapter 4. Based on the proposed model the best phase shift was calculated to be 126° compared with experimental results of 115°. It is felt that a longer power series will result in a better estimation.

6.3 SUGGESTIONS FOR FUTURE STUDIES

It will be worthwhile to consider the following suggestions for future studies on the topic of alpha bio-feedback.

1. The above studies may be extended to a set of all female subjects in the various age groups and to compare the results with an all male subjects in the respective age groups.

2. The above studies may also be conducted on children and as well as on elderly subjects.

3. It will be quite interesting to conduct the above studies on twins (male-male, female-female, female-male). Perhaps one may also include the case of Siamese twins.

4. The effect of day and night and also the effect of climatic conditions on the subjects and the resulting variations, if any, on the experimental results may also be investigated.