

EXECUTIVE SUMMARY KOCH 1936

Ludwig Koch was a psychologist. The purpose of Koch's research was to find a way to increase the speed of training CW. Here is an overview of his research. **Points of emphasis are in bold.** Takeaways of relevance to LICW are underlined.

LEARNING CW BY ACCOUSTIC SHAPES:

Koch conducted sending and receiving experiments in order to determine the optimum speed for learning CW. A full twenty five percent of the study details those experiments and their results. In summary, 12 WPM was found to be optimum for initial learning. Anything less than 10 WPM did not allow the student to perceive the characters as total acoustic patterns, which Koch referred to as the Gestalt effect. Gestalt is a German word whose equivalents in English are form or pattern. **The learning of CW by acoustic shapes is the recurring theme and focal point of Koch's report.**

"Apart from the small individual variations, as they were described last, the previous investigations about the Morse signal have shown that for the reception by the human being as a basic principle the working of the Morse signal as an acoustic wholeness, Gestalt, is a prerequisite. From this basic principle it follows that Morse code, according to the proportions of the international agreement, is usable only from about 50 Char/Min. (10 WPM) on. Then, however, this basic principle is quite satisfied. Below 50 Char/Min, the proportions according to the international proportions are unusable, because then shape decay occurs."

*"For the question of learning Morse code, this leads to the conclusion that **a learning procedure must establish the learning of Morse code as acoustic shapes as the first basic principle.**"*

Koch was very critical of previous efforts to teach CW by requiring students to memorize optical symbols on a chart, which he referred to as the analytical method. The mental process of copying code by that process requires counting the elements and reassembling them for comparison to the symbols imprinted in memory. That is inefficient but possible at a low tempo, but it is unachievable at faster speeds.

"The most important conclusion, which fundamentally determines the training procedure to be developed and also principally distinguishes it from

the previous procedures, relates to the giving (sending) speed during the training. Both the detailed studies of the relationship between the rate of call and the acoustic pickup by the radio operator and the study of the previous training procedures have shown that the critical rate for the changeover in the mental behavior during the pickup is 50 t/min (10 WPM)."

*"Therefore, if all these disadvantages associated with the changeover are to be avoided, **the training speed must be above this critical speed from the beginning.**"*

Further research and analyses will be required to reconcile Koch's findings with our use of modern Farnsworth techniques, but the takeaways for our club are to discourage the use of any chart containing the CW symbols and to send from the earliest stages of learning at speeds where characters are perceived as total acoustic patterns.

Koch experimented with two methods to enhance sound patterns and rhythm in new students:

The first experiment involved having students listen to code without being told what characters the sounds corresponded to. Students were asked to mark a sheet of paper by placing a dot each time they heard an acoustic shape. This introduced the learner to the rhythm and formed a connection between the acoustically recorded rhythm and the rhythm of the writing hand.

*"Above all, however, **this training on the rhythm also has the effect that the learner is inevitably led to listening to the underlying sound image.**"*

Consideration should be given to modifying how Beginners 1 and 2 instructors introduce each new character by adopting the method of first playing it as a sound without telling the students what the corresponding character is. Only after students have had a chance to hear the sound and mark a sheet of paper with a dit, should the sound be associated with a character. Incorporating this method would complement our best practice of introducing characters with the technique of (1) hear a letter, (2) say a letter, and (3) send a letter.

The second experiment involved amplification of the acoustic gestalt effect by using a two-tone process. The concept was to relieve the considerable concentration required for a new student to differentiate between dits and

dahs by playing them at different tones. Doing so was found to facilitate the differentiation by making the code itself melodic. The dash was given a slightly higher pitch than the dit. The pitch differential was gradually reduced with each new letter and completely eliminated by the time one third of the characters had been introduced. Side by side tests revealed students introduced to code using a two-toned process learned faster.

Koch modified his character sequence for this experiment by placing easy letters (H F A B G C D E) in the beginning where maximum efficacy of the two-tone technique would occur. This calls the two-tone experiment into question. Additionally, Taylor (1943) reviewed the two-tone experiment:

*"With this change in procedure, he taught a second group of an unspecified number of students. This group attained in 24 half-hours the standard of performance which the first group had attained in 27 half-hours, a difference which, however, probably **can not be regarded as significant.**"*

The two-tone process is not recommended at this time. Further analyses of the concept should be referred to our members exploring the connection between CW and music.

CHARACTER SEQUENCE:

LICW adopted the sequence of characters from the G4FON trainer referred to as the Koch Method. That sequence is not mentioned in the 1936 report. The actual sequence chosen by Koch may be derived from the five letter groups on page 56:

"The sequence of letters chosen for our method on the basis of these considerations and other practical experience is given on p. 56."

L F C K R D P X Y Q B G A N Z U V W J H S I E O M T

- The sequence is weighted heavily to the front with difficult letters in English but is more evenly distributed in German. **This is consistent with the Koch Method:**
 - *"it would be more appropriate to place the difficult letters in or after the first third of the training."*
- LF, KR, PX and AN are mirror images. **This is consistent with the Koch Method:**

- *"Such characters, whose optical symbol are mirror images, give little possibility of confusion as acoustic shapes despite their optical similarity."*
- H S I E is a reverse dit challenge and O M T is a reverse dah challenge. **This is inconsistent with the Koch Method:**
 - *"One could assume that this would train the ear especially well in the beginning to distinguish fine differences. However, it has been shown that the negative effects resulting from the great demands on concentration exceed the advantages of such auditory training."*
- H S, U V and W J are similar. **This is inconsistent with the Koch Method:**
 - *"Those Morse code symbols whose sound patterns are confusingly similar can be difficult for the beginner to distinguish at a higher speed." "Letter combinations such as s and h, or u and v, or d and b should be avoided."*

Further analyses of the Koch sequence as well as others used by various training organizations is warranted.

APTITUDE:

Koch was not tasked with the development of a suitability test, but his experiences strongly suggested that a valid estimate of a man's ability to learn to receive may be made on the basis of the speed with which he learns the first few characters of the code. This was validated by Taylor (1943) as the best test developed for use in the selection of men for training in code.

Early progress in Beginners 1 may be the best predictor of eventual success.

OPTIMUM DURATION OF TRAINING:

The results about the effect of repetitions and their distribution on the learning success were found especially interesting. For example, JOST 1 found:

"The more number of repetitions are distributed, spaced apart in time, the faster one learns and the better one retains."

"The position and distribution of the training hours have considerable

influence on the training result.”

According to Koch's experiences, **half an hour of continuous practice is the most favorable duration. Furthermore, practice in the morning and in the afternoon for half an hour each, yields the best and fastest success.**

THE KOCH METHOD SUMMARIZED:

- (1) CW must be learned as acoustic shapes.
- (2) CW should be sent at speeds above 10 WPM. 12 WPM is optimum.
- (3) Visual charts should never be used.
- (4) Amplify the acoustic gestalt effect by using a two-tone process.
- (5) Start with two well-differentiated sound patterns such as K and M (others are fine).
- (6) When preparing a student to be a professional telegrapher, arrange groups of letters of 5 characters each in order to accustom them to the arrangement of practical radio traffic from the beginning.
- (6) Begin by having students listen to code without being told what characters the sounds corresponded to. Students should mark a sheet of paper by placing a dot each time they hear an acoustic shape.
- (7) Associate the acoustic shapes with their associated characters.
- (8) After a short period of practice, the relationships between the acoustic impression and the represented characters are firmly established. Only when this is achieved to about 90 percent accuracy, the next character may be added to the two sound images.
- (9) The sequence is always the same. Two known characters come first, the third is the new unknown sound image. The introduction of the characters is done in such a way that the new one is repeated twice at the beginning and twice at the end.
- (10) Maintain a tempo of 12 WPM until all characters are mastered, then gradually increase speed toward the goal of 20 WPM.

RECOMMENDATIONS SUMMARIZED:

- (1) CW should be sent from the earliest stages of learning at speeds where characters are perceived as total acoustic patterns.
- (2) Use of Farnsworth should be reevaluated.
- (3) Use of any chart containing CW symbols should be discouraged.
- (4) Consideration should be given to modifying how each new character is introduced by adopting the method of first playing it as a sound without telling the students what the corresponding character is.
- (5) The two-tone process should be referred to our members exploring the connection between CW and music.
- (6) A full assessment of the Koch Method and its applicability to LICW teaching methods is warranted. This should include further analyses of the Koch sequence as well as others used by various training organizations.