APPENDIX III

PERCEPTION EXPERIMENTS

The Scandinavian Lurs exhibit various features whose presence is difficult to explain without some objective basis for assessing the degree of similarity of one instrument to another and the uniformity of the morphological form of individual instruments.

All of the features are interdependent and many can be expressed as secondary derivitives of other primary ones. For example, a variation of taper can be expressed as variation of end diameters of a given length of taper.

Neglecting their interdependence the features of interest are:-

l. Degree of roundness of individual elements of instruments.

2. Similarity of diameters between individual instruments of a pair.

5. Similarity of diameters throughout the whole group of lurs.

6. Similarity of slopes (derivative of length and diameters) between individual instruments of pairs.

5. Uniformity of individual slopes on elements of instruments.

6. Similarity of slopes between adjacent segments of individual instruments.

Interpretation of these features involves a judgement to be made as to their mode of manufacture, i.e. to determine if the consistent features were created simply by assessing diameter and slope by visual and tactile stimuli-or by techniques similar to those of modern engineering, i.e. gauging or measurement. Were figures to be available that defined the perceptual ability of the human to discriminate small differences of morphology, it would be possible to arrive at a value for the probability of these instruments having been made using only subjective (non—comparative) measurement in the derivation of their form.

As the manufacturer would have a wide range of stimuli, visual,

tactile etc. available, any work to arrive at values for this discrimatory ability would need to allow the subjects the same range of stimuli. Such experimentation differs from that normally carried by perceptual psychologists as the interpretation of data where more than one modality has been allowed to vary is complex when carried out rigidly. However, as a manufacturer would have available whatever techniques could be devised at the time to determine values for morphology any experiment carried out must allow the same latitude.

A search of the published literature was carried out in an attempt to locate any work that has been previously carried out in this field and thus help to establish an objective basis for assessing the dimensional acuity and stability of the perceptual process.

As no previous work appears to have been carried out to determine values for such features as outlined above, an experiment was designed in an attempt to determine whether such values can be determined with any degree of objectivity and what the magnitude of these values is.

However, as the experiment was being designed, it became apparent that the multi-modal testing proposed was quite novel. Hence, lacking any basic data upon which to base the design of the test specimens, a whole preliminary series of experiments would be required prior to the design of the experiment proper. lt was decided to abandon this attempt to establish these figures as part of this study and to carry it out at a later date.

Much work had been done, including detailed design of the experiments prior to the realisation of the magnitude of the task. This appendix outlines some of the thinking that went into the design of just one experiment, that testing for roundness discrimination.

DEPARTURES FROM ROUNDNESS

These can be described in two ways,as the difference between the largest and smallest radii of the measured profile measured from one or other of the centres:

i) the centre for which the radial difference has the smallest value

ii) the centre of a circle from which the sum of the squares of a sufficient number of equally spaced radial ordinates has a minimum value.[239]

Error in roundness may take many forms and as “natural" resulting from a hand manufacturing process is generally non-uniform. However, in order to be able to carry out an experiment that comes to a conclusion, however incomplete, it is necessary to manufacture specimens with limited, deliberately built in and quantifiable error. Were this limitation accepted, an almost infinite number of specimens would be required to obtain the required information.

A circle can be defined as a polygon with an infinite number of sides, the planeness of these being undetectable because of their size. However, as the number of sides decreases and hence, their size increases, they become individually detectable and the object is no longer perceived as circle, in the limit, with three plane sides, being perceived as a triangle and, with two curved sides, being perceived as an oval. This type of error is likely to occur where a circle is produced by the working of a tool backwards and forwards in the direction

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[239] Definition from BS3730:1964 "Methods for the assessment of departures from roundness.”

of its longitudinal axis. lt is noticably present on many round objects made by hand and in particular is quite readily detectable on the Gullåkra instrument.

However, in the forms examined, the degree of regularity in their shape is very much less than the regular polygon exhibits and the variations from this model are described below, the reference letters also refer to Figure 1:

a) Sides do not meet each other, i.e. angle subtended at centre not 360°.

b) Pairs of sides are replaced by a single side.

c) Sides are of totally irregular size.

d) The intersection of sides blends in with these, i.e. the edge is removed by a radius whose size can vary.

e) Unlike on a polygon the sides are not plane surface but may be curved or otherwise irregular in shape.

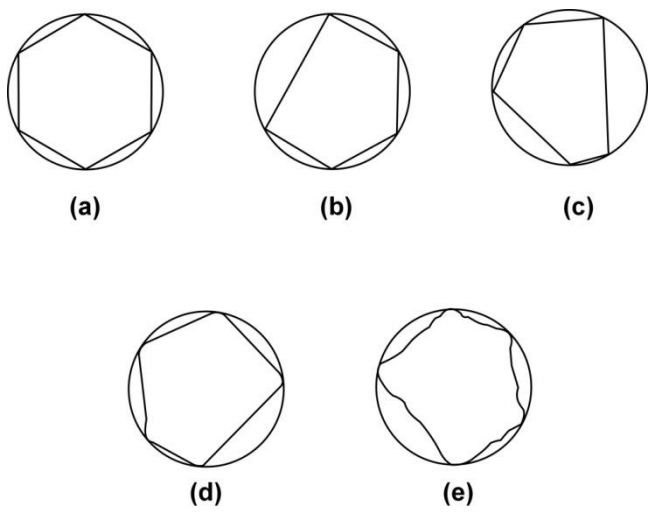

Figure 1: Departures from Roundness

Obviously, samples cannot be made to test for all the above conditions over a range of absolute errors, so some judgement must be made as to which elements will be incorporated in the design of the specimens.

A basic specification was evolved for the specimen design as follows:-

The specimens should:

a) be all of the same weight

b) be all of the same length

c) present no clear visual clues to roundness on their end

faces

d) contain no regular error that can be more readily detected by virtue of this regularity

e) individually, be of roughly the same out-of-roundness when viewed from different angles, i.e.

f) present no edges between any element of true diameter and error surface, i.e. be smoothly radiused in.

In an ideal situation the number of sides (N) of the generating polygon upon which the form was constructed would be an experimental variable as it is quite likely that absolute values of the detectable increment would vary with N.

Detail manufacturing drawings were produced based on these criteria.