1 Introduction

A new design has been devised for the tactile patterns in the current series of Netherlands banknotes. It differs markedly from those used so far, on Netherlands and foreign banknotes. In this presentation, I would like to explain the thinking that has led to the new design, and why the new patterns are more effective than the previous ones. I will conclude my presentation with a recipe for designing such a tactile pattern.

2 First principles

Let us start with first principles. Banknotes, that is to say, the images printed on the front and the back, and the shadow watermark, are typically designed for visual discernment. They can be recognised by everyone except the visually handicapped. As one of the printing techniques applied is intaglio printing, which leaves a mark clear to the touch in and on the paper, it should in principle be possible to deploy this relief for special tactile patterns for the visually handicapped.

3 Braille characters unsuitable

Naturally, the first thing that springs to mind is Braille characters. True Braille characters, however, stand up higher than the highest relief that can
be achieved by plate printing. Originally, when the first banknote with a special tactile pattern was issued, it was believed that a widening of the dots could compensate for the lack of height, but this appears to be a mistake in thinking. The following very simple experiment may prove my point.

4 A very simple experiment

A normal sheet of writing paper is approximately 0.1 mm thick, which is about the same as the maximum plate printing relief on banknotes. If such a sheet of paper is put on a flat tabletop, it is very easy — even for people with normal eyesight — to feel its edges. The smooth surface of the sheet, however, cannot be distinguished from the surface of the tabletop. This simple experiment demonstrates convincingly that a flat surface as such or its extent cannot be recognised, but only its sharp edges owing to the differences in height. So tactile identification patterns will be optimal when they have the maximum height obtainable by plate printing and expose as many sharp edges to the touch as possible. (As an aside, this simple experiment may also serve to demonstrate that persons without a visual handicap but blindfolded are representative of the class of blind for which the tactile identification patterns are intended.)

5 Edges and oscillations

A further improvement in the tactility of identification patterns appears feasible. According to the literature, fingers are not only sensitive to a sharp edge representing a certain difference in height, but also to oscillations. Oscillations of a certain frequency may be generated by running one’s finger at the appropriate speed over a stationary corrugated pattern. A pattern, which consists of an identical mark repeated many times over, laid out in a grid, is capable of generating such an oscillation in a finger. The distance between the marks would have to be approximately as wide as each mark, to make sure that the marks do not stand out separately but reinforce each other’s tactile effect.

6 Empirical evidence

Was there any evidence that this line of thought would lead to an improvement? The first banknote provided with tactile patterns aimed at the blind
and visually handicapped was the previous 10-Guilder banknote, which appeared in January 1971. It had three large circular dots. As you are all aware, it worked but not satisfactorily. The dots could be felt, it is true, but only by experienced people and the relief became gradually lost in circulation because of relaxation of the imprint and the development of adjacent creases in the paper. The other banknotes in the same series had similar patterns of dots and produced similar results.

Then the 50-Guilder banknote with the image of a Sunflower appeared featuring a triangular mark. Its tactility was already better because of the longer total length of the edges. However, more impressive, on the back of the note there was a pattern of parallel vertical straight lines. Its tactility was superior to that of the official, triangular, mark for the blind but this effect was not publicised.

Again a few years later the 250-Guilder banknote featuring a Lighthouse appeared with a pattern in the form of LL (two L’s intertwined). Equally, this pattern was an improvement on the previous circular dots because of the increased length of the edges, but, again, another pattern consisting of vertical straight lines in the lighthouse itself performed even better.

That is where we stood when we started our latest series with the abstract designs.

7 Textures

The first banknote in our latest series, the 25-Guilder banknote, tries to bring the principle just set out into practice but should yet be deemed a failure in this respect. The second banknote, however, the 100-Guilder, is covered with a regular pattern, or ‘texture’, consisting of a quadrilateral array of tiny raised dots. The extent to which the note is covered by the texture is quite large: something like one-third. As such a large pattern would not leave much room for other patterns and would unduly dominate the design, it is printed in transparent ink through which the underlying patterns printed in offset can be clearly discerned. In fact, the texture is quite unobtrusive. The choice of transparent ink entails an unintended second advantage: it is not copied by colour copying machines so that the tactility cannot be imitated by such means as swelling inks.

In short, the application of textures is a distinct success. The tactility is impressive and does not decrease below the level of recognition during circulation. Accordingly, we repeated the same principle for the 1000-Guilder and the 10-Guilder banknotes, which were issued later. They bear a texture in the form of wavy parallel lines at an angle of approximately $45^\circ$ and a
Figure 1: Lay-out of a quadrilateral grid consisting of tiny dots. The five parameters indicated below are freely adjustable.

Figure 1 presents, as an example, a texture consisting of tiny dots laid out in a quadrilateral grid. It resembles the texture we invented for the 100-Guilder banknote in circulation since 1993 which features an owl in the watermark. In this example five parameters are freely adjustable but the number of parameters is not fixed. It is feasible to design the texture such that a larger number of parameters are adjustable. The five parameters of the example are:

1. diameter of the dot,
2. horizontal distance between the grid lines,
3. vertical distance between the grid lines,
4. angle between the grid lines, and
5. number of dots per cell.

8 Recipe for an effective tactile pattern

By way of summary and conclusion, I now give a recipe for designing an effective tactile pattern in the form of a texture.

1. For one, aim at a texture in which the total number and the total length of the edges is as large as possible.

2. Choose an elementary mark, such as
   - a tiny dot
   - a cross
   - a chevron
   - or a straight or wavy line

   Make the lines of the mark as narrow as possible.

3. Choose the layout of a basic one- or two-dimensional grid in the form of
   - parallel lines
   - a square grid
   - a rectangular grid
   - a quadrilateral grid
   - a hexagonal grid

   or whatever.

4. Decide on the sizes of the grid lengths.

5. Decide on the outline of the grid, taking account of the other design elements in the banknote.

6. Arrange the tiny marks according to the grid, for instance on the crossing points or on the sides.

7. Should the texture not hide the other elements in the banknote, choose a transparent printing ink.

8. Finally, print the texture in intaglio with the maximum achievable height.
Note

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