Fish eye and kozibe

Erik Wanten - WTOCD

1. Introduction

The optical appearance of a brilliant cut depends on the parameters of its different parts[1]. Not all combinations of the parameters give the desired optical result. There is a contradiction in achieving a high yield and obtaining a high optical performance. Two undesirable optical effects are the "fish eye" effect and the "kozibe" effect. The name kozibe is an abbreviation of "Kollet zichtbaar in bezelen" which is Dutch for "culet visible in bezels". The terminology was introduced by HRD Antwerp and used in popular software like DiamCalc from Octonus[*]. Both effects appear when border case parameters are applied in order to gain more weight. In the present article we will explain how to calculate the effects.

1.1 Fish eye effect

The fish eye effect is the visualization of the girdle seen through the table of a brilliant. The primary parameters that influence this phenomenon are the table size, the pavilion angle, the pavilion half angle and the girdle height. Because the table is a polygon and not a circle the effect is less disturbing when it is only visible in the corners of the table. The formula is divided in two parts:

- A part which describes a **partially visible** fish eye effect calculated with **the girdle height** and **the pavilion angle** as parameters.
- Another part which describes **the entirely visible** fish eye effect calculated with **the girdle height** and **the pavilion half angle** as parameters.

[1] "The brilliant cut", Erik Wanten, WTOCD (www.wtocd.be)

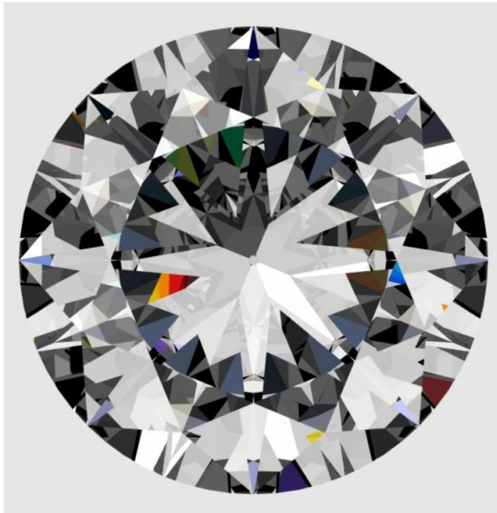

Figure 3: Partially visible fish eye

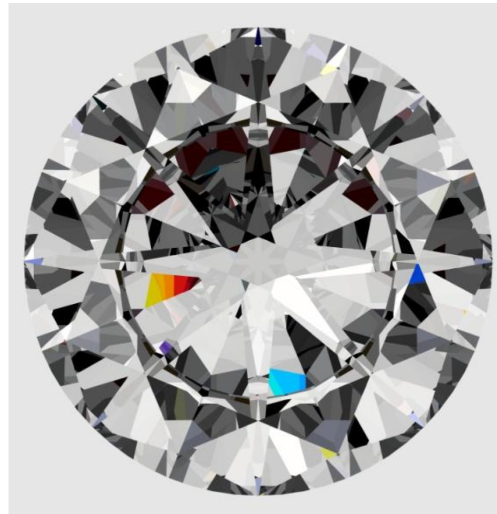

Figure 1: Entirely visible fish eye

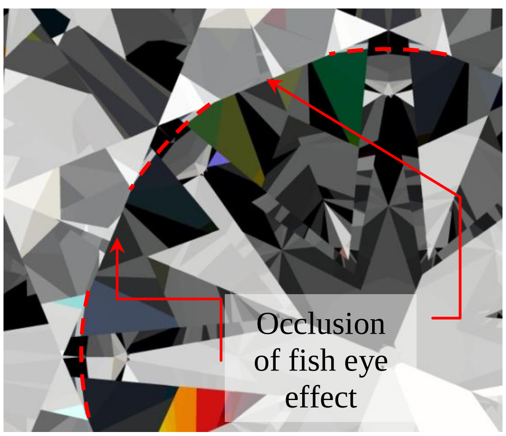

Figure 2: Detail of partially visible fish eye

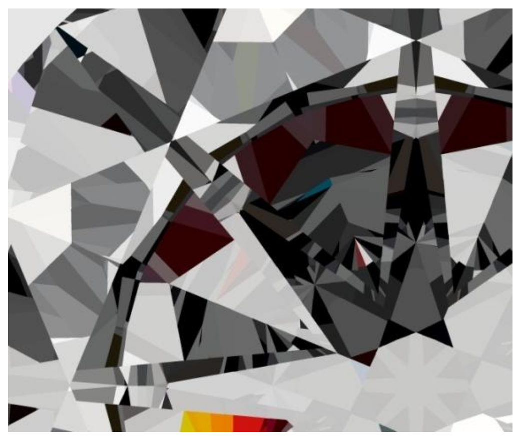

Figure 4: Detail of entirely visible fish eye

If $\alpha =$ pavilion angle and *Hr* = girdle height then:

$$\emptyset_{Minfe} = -\frac{\cos 3 \propto}{\cos \propto} - 2.Hr.\sin 4 \propto \qquad (1.1)$$

Formula 1.1 gives **the minimum fish eye diameter**. This means that the table size needed to create a partially visible fish eye effect must be greater than the minimum fish eye diameter. The effect is clearly visible when tilting the stone.

If α_h = pavilion half angle and *Hr* = girdle height then:

$$\emptyset_{Maxfe} = -\frac{\cos 3 \propto_h}{\cos \propto_h} - 2. \sin 4 \propto_h . \left(Hr - \frac{1}{2} . \left(1 - \cos\frac{\pi}{16}\right) . \tan \alpha_h \right) \qquad (1.2)$$

Formula 1.2 gives **the maximum fish eye diameter**. This means that the table size needed to see the entire girdle reflected in the table must be greater than the maximum fish eye diameter.

Must we at all time avoid the fish eye effect?

The effect is not that disturbing if the fish eye diameter is close to the lower limit. However it is clear that the optical parameters do not get better when approaching the fish eye limits! Only in special cases where the weight loss of removing the fish eye gives a huge financial punishment a manufacturer can consider to keep the effect. The surface quality of the girdle is very important in the appreciation of the fish eye effect. Bruted girdles emphasize the effect so that it looks like a sort of white, ring shaped, inclusion. Polishing the girdle, certainly for the minimum fish eye diameter, gives a less visible effect.

1.2 "Culet visible in bezels" or Kozibe-effect

This effect appears when a high crown is used together with a small table and a steep pavilion angle. The effect has a negative influence on the brightness of the crown and indicates "hidden weight".

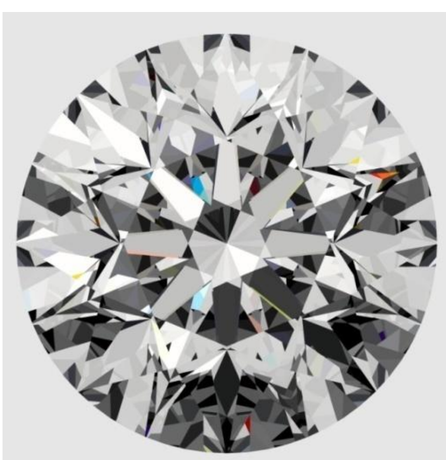

Figure 6: Brilliant with kozibe effect

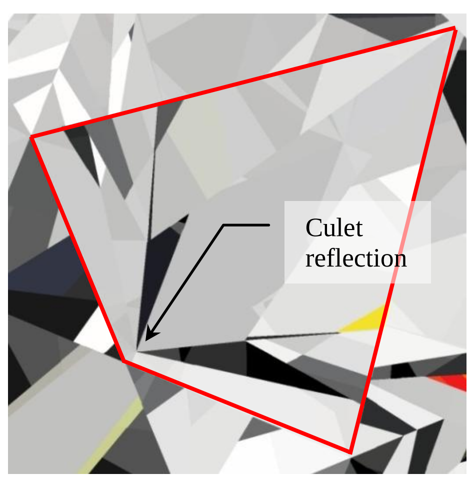

Figure 5: Detail of kozibe effect

If $ß$ = crown angle, Hp = pavilion depth and Hr = girdle height then:

$$\varnothing_{kozibe} = \frac{(\tan\beta + 2.Hr + 2.Hp)}{\left(\tan\beta + \frac{1}{\tan(\beta - g)}\right)} \qquad (1.3)$$

With g:

$$g = \tan^{-1}\left(\frac{\sin\beta}{\sqrt{-\sin\beta^2 + 5.846}}\right) \qquad (1.4)$$

Formula 1.3 gives **the kozibe-diameter**.
The effect appears when the table size is smaller the kozibe-diameter.

Must we at all time avoid the kozibe effect?

The influence on the optical appearance of the brilliant is less dramatic than the fish eye effect. In many cases the only reason for a manufacturer to allow the effect is the improvement on the weight. Many labs will downgrade the brilliant because of the "hidden weight".

---

* All images made with DiamCalc Pro from Octonus Software Ltd (www.octonus.com)