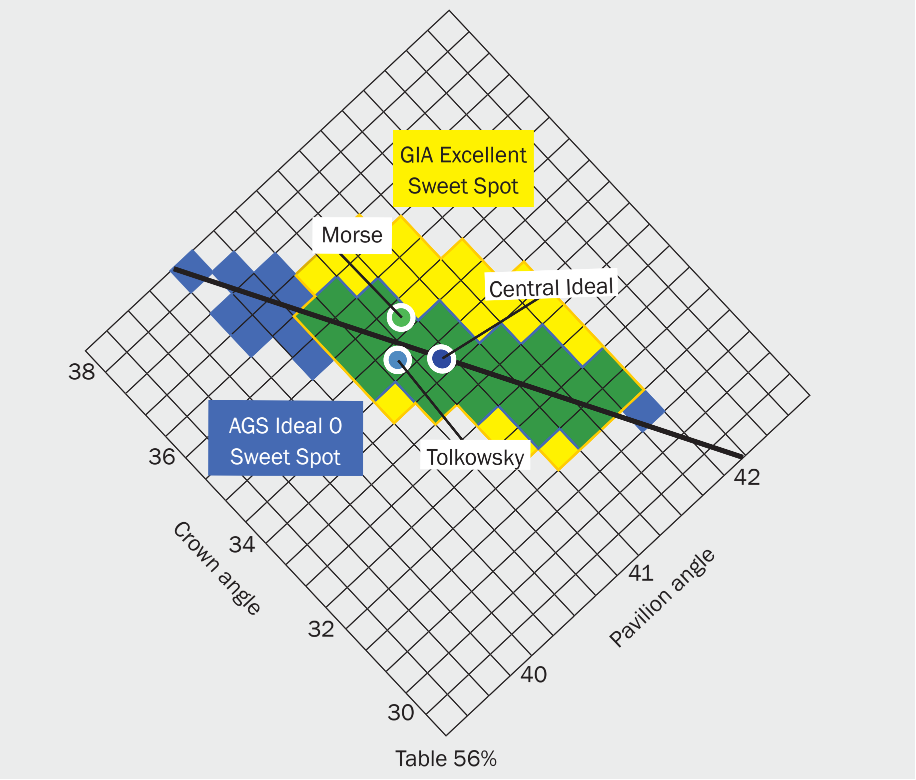
# The Central Ideal

Have you heard of the 'American Ideal' or 'Tolkowsky Ideal' in diamond cutting? How about the 'Morse Ideal'? Michael Cowing explains that because a majority of diamonds are fashioned as 57-facet round brilliants, many are familiar with the 'Holy Grail' of this cut, the 'Ideal' brilliant. The diamond trade often refers to this cut as the American or Tolkowsky Ideal. GIA's Al Gilbertson, in *The American Cut — The First 100 Years*, establishes the origins of the 'Ideal' with one of the first American diamond cutters, Henry Morse, in Boston back in the 1860s. This ideal in diamond fashioning was gaining in popularity when Marcel Tolkowsky published his book *Diamond Design* in London in 1919. Tolkowsky's book and the subsequent promotion of his theoretical cutting angles by the Gemological Institute of America (GIA) and the American Gem Society (AGS) resulted in recognition of the 'Ideal' worldwide.

Tolkowsky's mathematics and ray tracing validated the angles Morse had developed, and resulted in the acceptance of Tolkowsky's theoretical pavilion and crown main angles (40.75°, 34.5°) as the ideal in diamond cutting. For over half a century the GIA, AGS and many others supported these angles as the pinnacle of light performance in the round brilliant. The belief was that round brilliant diamonds cut to these angles were the most beautiful, possessing the best combination of brilliance (brightness and contrast), fire (rainbow colours of dispersion) and scintillation (sparkle with movement).

In 1998 GIA startled the diamond world by withdrawing its former support for Tolkowsky's single angle combination, declaring that their research had shown that there was a range of angle combinations with as-good or better brilliance. The AGS, as well,



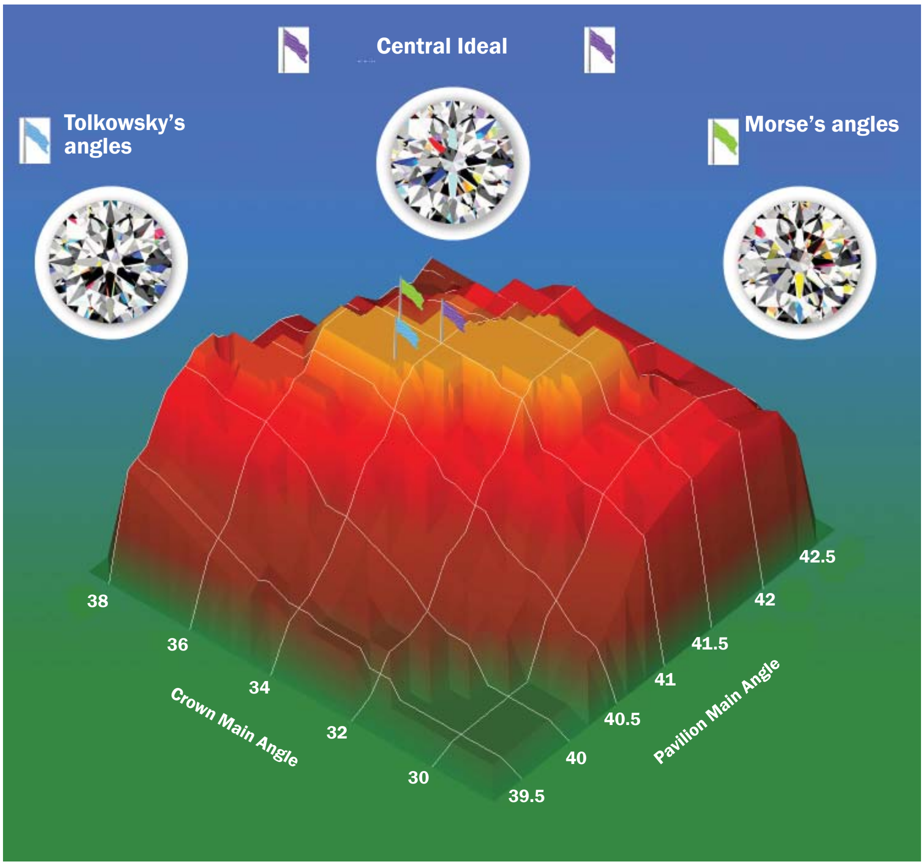

*1: Graph of the 'sweet spot' plateaus of GIA and AGS showing the locations of the 'Central Ideal' and the Morse and Tolkowsky angle combinations.*

found a range of angle combinations, though marginally different from GIA's, that displayed the Tolkowsky top performance. Others also found that, although the angles of Morse and Tolkowsky resulted in top performing diamond beauty, equally beautiful diamonds could be obtained over a range of angle combinations (**1**).

This range of angle combinations, what could be called a 'sweet spot' in round brilliant diamond cutting, ended the belief in an Everest-like single peak of light performance. This kind of image was instead replaced with what could more accurately be described as a 'peak plateau at the mountain top of diamond beauty'. Within this plateau or 'sweet spot' area there is ideal, top, but essentially equivalent, diamond light performance. The 'Central Ideal', unlike an Everest-like peak, is the target centre point of that plateau. The 3-D graph (**2**) illustrates the combined GIA–AGS 'sweet spot' plateau.

Like the 'sweet spot' in a tennis racket or golf club head, where the ball is struck with best effect, cutting within the 'sweet spot' range results in the diamond's best light performance. Shown in **1** and **2**, the range of this sweet spot plateau encompasses the pavilion and crown angles long associated with the 'Ideal' cut, those of Morse (41°, 35°) and Tolkowsky (40.75°, 34.5°). When the cutter fashions the diamond by aiming for the target centre and stays within the sweet spot range, the diamond responds with the best light performance and beauty.

The surprising discovery is that GIA and AGS, as well as cutters of the 'Ideal' and others, have almost identical centres to their respective sweet spots for table %, pavilion and crown angle (56%, 41° and 34°), even though the range of each varies in shape and extent. For instance, notice in the graph shown in **1** that the sweet spot plateau of the AGS 'Ideal 0' (the blue area) is a flatter, thinner ridge compared to the wider plateau of the GIA 'Excellent' (the yellow area). The author and many cutters of 'Ideals' have a still smaller sweet spot range around the Central Ideal that we find to be best. For example, from the 1970s the Institute for Technical Training in Antwerp, Belgium, taught angle combinations of 41° and 34° – 34.2° (Dirk Verbiest, pers. comm.). In




*2: 3-D graph of diamond light performance and beauty.*

the same time frame, but a continent away in Johannesburg, South Africa, the Katz Diamond Cutting Factory was teaching its apprentices to cut the Ideal Round Brilliant to a 41° pavilion main angle and a 33° to 35° crown main angle (P. Van Emmenis, pers. comm.). A conclusion reported by Cowing (2007, *The Journal of Gemmology*) was that diamond cutters were correct in their adherence to close to a 41° pavilion angle.

In **2** is a more vivid 3-D representation of the range of 'Ideal' that is in common between the ranges of GIA 'Excellent' and AGS 'Ideal 0' (the overlapping green area in **1**). This 3-D graph shows with coloured flags, the locations of the 'Central Ideal' and the Morse and Tolkowsky angle combinations.

This 3-D dipiction of light performance can serve as a guideline for cutters striving for top performance and maximum yield. A key observation is that according to the 3-D graph of GIA-AGS light performance (**2**), a diamond cutter could obtain equivalent light performance by moving to the right on the plateau to (41.5°, 32°). Not only is equivalent light performance indicated by both GIA and AGS, but cutting to either this combination or the 'Central Ideal' combination of (41°, 34°) enables greater weight retention from typical diamond rough than is obtained when cutting to Tolkowsky's theoretical angles. Top performance with greater weight retention from the rough crystal is a big win-win in diamond cutting.

The close agreement in the 'Central Ideal' location is true not only for the three diamond features of table size, pavilion and crown main angles, but also for all seven angles and proportions that make up the round brilliant cut. For the round brilliant, the finest or ideal beauty is attained in the narrow range of parameter combinations, around the 'Central Ideal', where this cut

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# The Central Ideal (continued)

3. *Photograph of an Ideal Cut taken under contrasty, 'fire friendly', patchy blue sky.*

4. *'Central Ideal' cut simulation in high contrast lighting with close-viewing, observer obstruction.*

5. *Photograph of an Ideal Cut taken under contrasty, 'fire friendly', spot illumination.*

exhibits the best distribution of brilliance (in both its aspects of brightness and contrast), fire and sparkle. This is especially true of the 'Ideal' when viewed, not only in favourable lighting like that in **3**, **4** and **5**, but most importantly, in more usual illumination such as is found in homes and offices.

After considering the GIA and AGS sweet-spot parameter centres, along with the knowledge gained from his own research, the author concluded that the seven-parameter target 'Central Ideal' for the round brilliant, listed in order of importance is:

1. Pavilion main angle = 41°
2. Length of pavilion halves = 77%
3. Crown main angle = 34°
4. Table size = 56%
5. Star Length = 55%
6. Girdle size = thin to medium
7. Culet size = small to none

These proportions agree with those of many cutters of the 'Ideal' and diamond cutting institutions. They accord with the writer's knowledge of the parameters that result in ideal beauty in the round brilliant.

There remain important differences among the various cut-grading systems. Even within the sweet spot in common between GIA and AGS there are small, but observable differences in light performance. This is most apparent in less favourable illumination. When examining a diamond closely, the greater light obstruction from the observer's head and body affects the pattern of reflections seen. These differences in light performance lead to preferences, even within the top performance plateaus of GIA and AGS.

However, in the final analysis, close agreement is found in the target centre of best round-brilliant light performance, the 'Central Ideal'.

## The Author

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Details and a full exposition of the 'Ideal' in diamond cutting can be found in 'Accordance in round brilliant diamond cutting', *The Journal of Gemmology*, 2007, **30**(5/6), 320–30, which can also be found on the author's website at www.acagemlab.com/news/JoG07305.pdf.