L2/12-057

"size 9, centered" a misnamed measure

ISO/IEC JTC1/SC2/WG2 N 4115, Proposal to add Wingdings and Webdings Symbols, introduces a "9th shape … 'centered' in the 1480 square…".

The definition given closely matches that already in use for UTR 25-style "regular" sized shapes, and can also be unified with the N4115-style "regular" size. Wingding's classification scheme can thus be put into a one-to-one correspondence with UTR 25's classification scheme.

To quote N4115,

> "*A 9th sized shape is defined to be 'centered' in the 1480 square and consequently the ink size is determined by that shape. For example, the size of the sides of the centered square is 1046 corresponding to a diagonal of 1480 which allows the diamond with the same side size to fit in the 1480 square".*

1 *A 9th sized shape is defined to be 'centered' in the 1480 square*

The second bullet point under "Geometric shapes sizes" reads "*Many geometric shapes are contained in a 1480×1480 unit box based on the default baseline (0 based) and centered in the middle (740)*".

That is to say, this "9th size" has the same central axis as other squares, diamonds, etc. Only the size is different.

2 *the size of the sides of the centered square is 1046*

Adding the square with side of length 1046 into N4115's main classification scheme, a convenient relationship is immediately apparent.

Version 2 in the table below is based on the amended classification derived in *"slightly small" a redundant measure*.

	squares	version 2		version 3		squares	
		ratio	side	ratio	side		
1	tiny	1.49	198	1.49	198	tiny	1
2	very small	1.33	296	1.33	296	very small	2
3	small	1.50	394	1.50	394	small	3
4	medium small	1.33	592	1.33	592	medium small	4
5	medium	1.32	790	1.32	790	medium	5
9	'centered'	1.13	1046	1.41	1046	regular	6
6	regular	1.25	1184		1480	large	7
7	large		1480				
8	XL		2048		2048	XL	8

Item 6 of Wingding's classification scheme (square of side 1184) disrupts the graduated scale of sizes, but we can unify Wingding's *centered* and *regular* categories without difficulty.

The *regular* square is only 13% larger than its *centered* counterpart. At that rate, it would take approximately 48 increments to grow from *tiny* to *regular* – altogether too fine a granularity, so we can unify the two squares, without significant loss of information.

9	'centered'	▲	■	◆		
6	regular		■	◆	♦	●

Because the diamond is simply a rotated square, we can also unify the *centered* diamond with its *regular* counterpart. Some minor adjustments to the sizes of w-1116 and w-1108, the lozenge and the circle, and the job's done.

In version 3, following unification :

- there are now precisely as many points in the Wingdings classification as there are in UTR 25's;
- at each size, the names are identical;
- the ratio of tiny:regular is approximately 1:5, in both cases;
- the graduation of Wingdings sizes is now much smoother;
- the definition of the size of a "regular" square — sitting on the baseline, centred on the math axis — is precisely that used in Table 2.5 of UTR 25 (although UTR 25 does not specify this definition, it makes a reasonable starting point for any font being extended to include Geometric Shapes);
- N4115 already proposes that 3 "centered" Wingdings shapes be unified with shapes shown in UTR 25 as "regular"-sized shapes.

Of the 12 shapes listed as "size 9, centered", 7 are new to the Unicode Standard, 3 are unified with existing shapes, and 2 are duplicates:

- 7 new shapes

  2BB5 triangle up
  2BB6 triangle down
  2BB7 triangle left
  2BB8 triangle right
  2BB2 pentagon down
  2BB3 octagon horizontal
  2BB4 octagon up

- 3 unified shapes

  2B1F pentagon up
  2195 hexagon up
  2196 hexagon horizontal

- 2 shapes duplicated

  2BB0 square
  = 25A0
  2BB1 diamond
  = 25C6

That last example hides a problem.

3 *…the size of the sides of the centered square is 1046 corresponding to a diagonal of 1480 which allows the diamond with the same side size to fit in the 1480 square…*

That requirement could be expressed equally well, and more succinctly, as

"the centered square has the same circumscribed circle
as the centered diamond".

There are various methods for describing the overall "size" of a glyph:

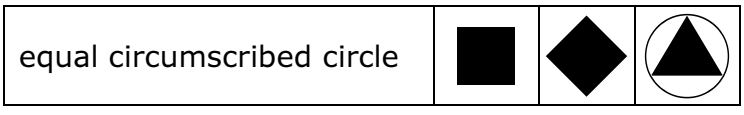
— Postscript users will be familiar with the "bounding box".

— A similar measure is the diameter of the (smallest possible) circumscribed circle.

— Yet another is the total area enclosed by the perimeter of the glyph (not difficult to calculate for regular geometric shapes).

The circumscribed circle works well with nearly all shapes, especially the regular non-convex shapes (stars and asterisks &c), but is not so good with the parallelogram and the ellipse (25B0, 2B2C, 2B2E, etc).

None of these measures define the vertical positioning. Where the circumscribed circle is centred on the math axis, and the shape in question is symmetric about the math axis, the results are OK, but look what happens with the upward-pointing triangle.



The medians of the triangle intersect at the mid-point of the circle, with the result that ⅔ of the vertical height of the triangle lies above the math axis, and ⅓ below. The outline appears raised, when compared with the square and the diamond, and this raised glyph is precisely what can be found at w-3129 (U+F081 of Windings 3).

With the exception of w-3130, all the other triangles appear to be vertically centred.

4 *…scaling of the geometric shapes should be harmonized with rules used in TR25, with the understanding that some existing characters may be resized to better align with Wingdings sizing rules…*

Using a certain amount of tedious arithmetic to clear away a certain amount of extraneous detail, we can see that Wingdings sizing rules are pretty well identical to UTR 25's.

	version 3	N4115	points at 72pt*	UTR Table 2.5	points at 72pt*
1	tiny	198	7	120	9
2	very small	296	10	166	12
3	small	394	14	228	16
4	medium small	592	21	315	23
5	medium	790 837	28 29	435	31
6	regular	1046	37	600	43
7	large	1480	52	827	60
	XL	2048	72	1000	72

* this is the height, in points, of the printed area of a square, when the glyph as a whole is scaled to 72pt.

That's the squares taken care of. We now need to know what sizes the other shapes should be, within a given category.

tiny	VS	S	MS	M	sz 9	Reg	L	XL
					▲		▲	
·	▪	▪	▪	■	■	■	■	■
·	⬩	⬩	◆	◆	◆	◆		
·	⬩	⬩	♦	♦		♦		
·	•	•	•	●		●	●	●

Wingdings' rules are not straightforward, but in practice they appear to be:

square : triangle
(size 9 only) → equal circumscribed circle (⌀1480)
(size L only) → equal height
square : diamond → equal side length
diamond : lozenge → equal height
square : circle → equal bounding box

Webdings and Wingdings make no allowance for visual impact.

UTR 25 says "*shapes of the same size should ideally have roughly the same visual "impact" as opposed to same nominal height or width*". The three measures above are all objective, and none provide a reliable measure of "visual impact".

A	equal bounding box	■	◆		
B	equal circumscribed circle	■	◆		
C	equal areas of black ink	■	▲	★	✸

As the quotations from N4115 make clear, Wingdings considers the first two shapes in example B to be in the same size category, although many people would find that the greater apparent width of the diamond gives it more visual impact than the square.

Something has to give, and the solution is provided by the first couple of sentences in the section on "Geometric shape sizes" in N4115:

> "*The set of four fonts are designed in a consistent manner with shapes that obey strict rules concerning vertical alignment and sizes. While it is not expected that these constraints would be imposed on every implementation of these characters, it is important to document them.*"

which may be taken as permission to centre glyphs vertically.

And apply scaling for equal visual impact, according to taste.