2π or not 2π?

π is defined as the ratio of the circumference to the diameter of a circle. But why the diameter? Why not the radius? If we define Π as the ratio of the circumference to the *radius* then $\Pi = 2\pi$. Which is better?

Game 1

It is immediately obvious to anyone with any knowledge of maths that the radius of a circle is a far more important concept than the diameter. The equation of a circle is $x^2 + y^2 = r^2$ not $x^2 + y^2 = d^2/4$. It makes more sense therefore to define the constant as the ratio of the circumference to the radius than to the diameter. The first game is conclusively won therefore by Π not π. This makes the formula for the circumference of a circle equal to Πr rather than $2\pi r$. Much better.

Score: 15 – luv

Game 2

OK – so radius is important; but if we are going to adopt Π *instead of* π *then the formula for the area of a circle is going to have to be made* $\Pi r^2/2$ *instead of the simpler* πr^2.

True – but this is the only formula that is simpler in terms of π ανδ there is nothing particularly special about the area of a circle. Other formulae, like the formula for the area of a sphere ($2\Pi r^2$ instead of $4\pi r^2$) are pretty much equal in simplicity. On balance, I would say there is nothing much in it. Lets play a let on this one.

Score: 15 – luv

Game 3

Lots of formulae involving rates of rotation have 2π in them e.g. $T = 2\pi\sqrt{l/g}$ for the period of a pendulum. This is all because frequency f is equal to $2\pi\omega$. All of these formulae would be simplified if we adopted Π instead. Definitely one for me.

Score: 30 – luv

Game 4

Yes, but Euler's famous formula $e^{i\pi} = -1$ *has* π *in it not* 2π*. It would look really ugly if it had a 2 in it as well.*

I agree, actually, it would. But it is still a bit ugly anyway because of that minus sign. Indeed, many authors including Wikipedia have tried to get rid of the minus sign by writing the equation as $e^{i\pi}+1 = 0$ and claiming for it a kind of mystical significance because it not only contains the seven most important symbols in mathematics but also the three most important binary functions. If you think about it you will realise that the most elegant way of writing Euler's marvellous equation is in fact $e^{i\Pi} = 1$ – so I win that one as well!

Score: 40 – luv

Game 5

What about series formulae for the expansion of π?

There are literally hundreds of formulae for but very few of them calculate π itself. They mostly calculate π/2 or π/6 or even 2/π . To be fair, none of them calculate Π either so this one is another let.

Score: 40 – luv

Game 6

For me, as a physicist, the match-winning stroke is the plethora of physics equations which are littered with multiples of 2π. And I am not just thinking of periodic formulae like that of the pendulum either. Even the most fundamental constant of all, the Dirac constant - *h*-bar - has to be written as *h*/2π.

Game, set and match

References

Having written the bulk of this article, I had a search on the web for similar articles and, not surprisingly, came up with a number of people with the same idea.

This one http://www.math.utah.edu/~palais/pi.pdf generated quite a lot of discussion.

Many respondents took the view that the issue was trivial. While I agree that the situation cannot in reality be changed, I think the original decision was regrettable and that some of the beauty of mathematics has genuinely been obscured.