A Plea for a Simpler Mathematics

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Mathematics is too poorly understood today, even by its adherents. Ask a dozen mathematicians what maths is, and you'll get at least half a dozen qualitatively different answers. Ask them why they do maths, and half will talk of love and beauty, to which the non-mathematicians look on quizzically, as if these mathematics practising creatures are really aliens from another planet.

Mathematics really needn't be all that hard, either to do or to teach. It involves artistry and aesthetics, just as poetry and storytelling do; it involves written presentation and visual illustration just as most other modern books do. Despite these similarities, there is something very perculiar about mathematics, and it is from this that mathematics derives its strange form of beauty: whilst in many ways a human creation, the nature of mathematics is timeless truth: it is both an inhuman abstract truth and yet also a living expression of that truth.

I have lost count (or at least run out of fingers to count) the number of intelligent articulate friends who 'didn't get maths at school', when the way they speak English and interact with other humans indicates a depth of intuitive complexity that dominates much of mathematical thinking. Anybody who can speak English can do maths, and indeed does so more than they realise. The trouble is that we have lost touch with what maths is. To give my position I will begin with the following:

> Mathematics is the Art of Precise Efficient Communication.

why this matters to us is what happens if I add the word 'practical' and adjust the sentence to make sense to me:

> Practical Mathematics is the Art of Precise Efficient Communication about Real World Problems.

Efficiency comes from knowing both what needs to be transmitted from one person to another, and critically from what does not need to be transmitted, thus:

> Mathematics is the Art of Ignorance with respect to Real World Problems.

There is a saying involving killing birds with stones. Mathematics excels in this area, allowing us to solve many apparently unrelated problems with a few strokes of a pen. The ignorance that mathematicians carefully employ is better known under the name of 'abstraction', and mathematicians use of this is systematic. Thus

> Mathematics is the Art of Systematic Abstract Thought.

Mathematics is all these things, and a language in which all these things are done, and yet it is also the space of possibility into which Human mathematics is expanding: an ever-created world of possibility, some of which we have explored, some of which we have yet to explore, and the vast majority of which will never be explored by Humans. The power of mathematics is in what it allows us to do: create theories of the world like Physics, to create calculating machines like modern computers which can almost appear intelligent, and for which a discipline involving making them appear intelligent is of major importance and utility in the world today. The trouble is that this beautiful world of complex thought patterns should be for everyone, should help everyone, and should welcome everyone. In these areas mathematics is failing us, and this article is a plea for us to do something.

1   Principles

There is a famous principle with a single four-letter acronym: KISS, for Keep It Simple Stupid. Mathematics needs to be kept simple so that 'stupid people' can understand it, and once they can, they can hardly be said to be stupid anymore. But idiot proofing procedures does not work, as was famously observed regarding attempts to idiot proof computer procedures:

> "Programming today is a race between software engineers striving to build bigger and better idiot-proof programs, and the universe trying to produce bigger and better idiots. So far, the universe is winning."
>
> — *Rich Cook, author*

My attitude is that, in doing mathematics, we are often intoxicated by the possibilities of the maths, and forget about the humans doing it. Humans are emotional and spiritual beings, and this should not be forgotten. We love, and like to be loved; we play and like to play with others; we enjoy Fun, seek Joy, and love Beauty. So for me, maths done right comes down to a search for, exploration of, and sharing of, these three: Fun, Joy and Beauty. The most important is Beauty, for that is the ultimate defense against unnecessary complexity (which good mathematicians naturally perceive as ugliness).

That said, we cannot achieve mathematical beauty at the start: to begin we must begin as children begin learning, and that is through play and creative learning, so for beginners maths must be fun. Once we have begun, we will find that certain patterns occur again and again. It makes sense to drill ourselves in these patterns, provided we do not drive ourselves to dislike them, or even worse to hate them. Systematic practice, whilst not fun, should be enjoyable, and both feed of and feed a deeper joy that lines the road to understanding: we should feel that our efforts are worth it, and that they will pay off in the end.

In learning Tai Chi, I often remarked that 'one of these years, I will get what this stuff is about', and after eleven years I am starting to get there. Mathematics can take that time, but if pursued earnestly, can reward the effort in how it allows us to think. But the isolation of a mathematical hermit is not the way to go: mathematics should be a communal pursuit, albeit one which cultivates and rewards each human matheamticians individuality and flair, and yet allows them to function as part of a great mathematical orchestra.

2   Everyday mathematics

We have all, at some time or other, said something like:

> Can you grab the blue thing from the coffee table.

Now consider what is going on here: we want something which has not been named or described explicitly. All we have said is that it is blue and that it is on the coffee table. If there is precisely one blue thing on the coffee table, than any human who grasps basic English should understand which thing is meant. The word grab is an informal word for 'pick up', and there may be an implied 'do something with it' or 'bring it to me'. In formal mathematical language, expressed as a procedure, this everyday request would turn into the following behemoth:

1. In this house is a coffee table: please go to it.

2. On the coffee table there is a single object which is blue: please pick it up.

3. Then please wait for further instructions.

If we wished to instruct one of our modern calculating machines [1] to do something, in a language which the machine understood, then the end result would resemble this. Importantly we must not forget the lesson of history that the theory of computers arose from an attempt by mathematicians to mathematically model the logical thought processes of a working mathematician. A modern computer is really a mathematician, with the human being surgically removed, and sped up a billion fold. To see what I mean, the following is a valid expression in (the grammar of the language) Python 3, though it will not run since the interpreter does not know what a coffee table is.

```
h = House("this house")
c = h.getFromContents("coffee table")
o = c.findObjectOnTop("blue thing")
askMeWhatToDoNext()
```

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[1] 'Computers' is how we refer to them, although the use of the word computer predates digital electronics.