The development of COUNTING CARDS

A new maths aid for teaching place value, addition and subtraction up to 1 million

The need for a resource to help his wife understand place value motivated CHRISTIAN TAYLOR to create 'Counting Cards'. Here, Christian shares his invention, in the hope that it will help others.

Numeracy problems crop up in the most surprising places: it was when Denise (my wife, herself a teacher) was working on her statistics one evening, tying up some loose ends in her master's thesis, that this all started. She was processing some data using techniques that I had long ago forgotten from my university days (and never could understand in any case), when something came up about her figures: she casually commented that certain means were statistically different, but in another part of the table did not realise quite how different one 4 digit figure was from the 3 digit figure beside it. This I found very odd, being able to manually process and understand a statistical analysis, yet she did not fully appreciate the difference between 100 and 1000, let alone the higher orders of magnitude.

'I have never understood this,' she said, 'it's one of the things at school that they missed out, or escaped me: maybe I was off that day?'

However, discovering at the age of 40 that she was dyslexic, it is no surprise in retrospect that many things escaped her at school: being labelled a 'slow learner' she was almost written off by her teachers. (She has made up for it now: having completed her masters by research and getting a distinction in her research project, she is now a literacy co-ordinator and specialist dyslexia teacher in a large secondary school).

However, I digress a little: this numeracy anomaly was a bit like a red rag to a bull: how to communicate orders of magnitude to Denise in a way that she could understand, better than her teachers ever did all those years ago. So I set about with some designs on paper and played a bit on the computer. I wanted to show that 10 was ten times bigger than one, 100 ten times bigger than 10, 1000 ten times bigger than 100 etc. I wanted each value easily recognisable and I wanted to show how they were interrelated. I eventually came up with a design that I thought would work; the concept is as follows.

Unity is represented by a black spot (using black counters). Each higher place value (10, 100, etc.) is represented by a coloured card, which shows 10 of the previous (lower) denomination place value; i.e. 10 is represented on a yellow card by showing 10 black spots. It is easy to recognise that the yellow card is the same value as 10 since one can count the 10 black spots (Figure 1).

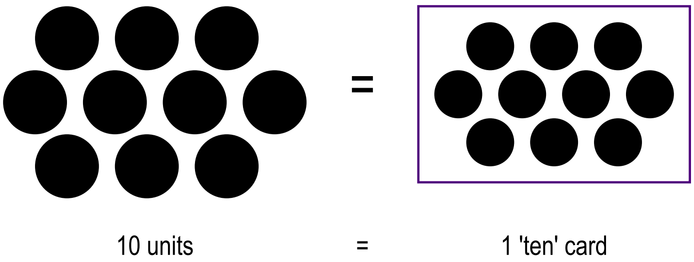

Figure 1

In the same way, 100 is represented on a green card, by showing ten yellow ('10') cards (100 spots), one thousand is represented on a blue card by showing ten green ('100') cards (1000 spots) (Figure 2) etc., up to one million. After 10 000 the black spots become too small to see, but one can count 10 000 black spots on the purple card (though I do not recommend it!). I made the cards bigger with each increment in magnitude to help convey increasing value.

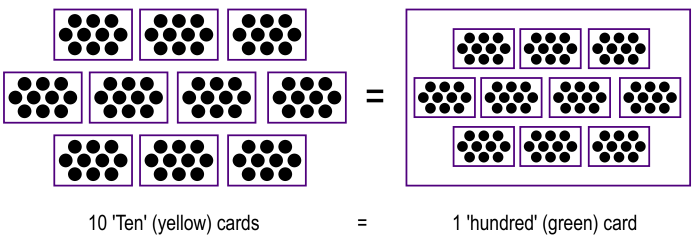

Figure 2

After printing up ten of each design, I sat down with Denise to see if they worked: we counted up using the cards, going up through the place values. I showed her the relationship between each design, how each was the same value as ten of the smaller ones: and within about five minutes, she had grasped the concept. It worked a treat.

So I then tried it out on some of my students at college: so many of our Entry and Foundation students have exactly the same problem: when they use a calculator they will read out the answer as a list of digits, but many have no idea how big the number is, or if the answer is in scale to the calculation. The cards seemed to work just as well with them.

I then began to play around with them some more, and found that they could be used not just to count up and down, but to add and subtract numbers from each other: by using the cards to represent numbers (Figure 3), one can add the numbers together and get answers by 'swapping' 10 smaller cards for the next larger card when 10 of any place value is reached (Figure 4). This shows students quite graphically, the need for 'carrying over' when doing addition and subtraction.

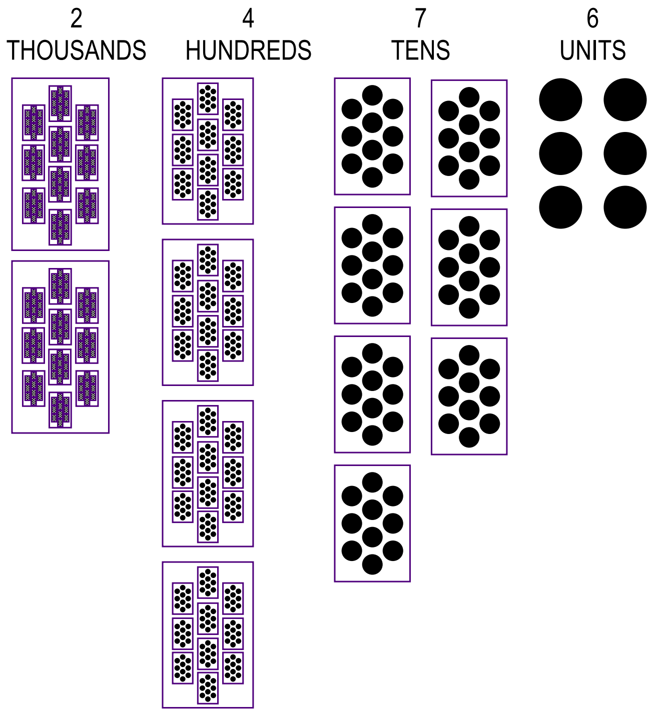

Figure 3

The next stage was to trial them in some local primary schools: I got some very useful feedback which helped me fine tune the designs:

- I modified the colours slightly to avoid the more common form of colour blindness;
- I added the place value titles (e.g. 10 Ten) as digits and words, on the back of each card, to help students learn and understand them and for

the teacher to use one as a column header when doing sums;

- I made them a bit bigger for ease of handling and recognition / counting;
- I substituted black counters for the original 'unit' card, which in the prototype was square: it was too small to handle and confused the concept slightly by being square, not round (like the spots)
- I removed a thin border from the cards, so that when the cards are placed together, students would recognise e.g. 30 as its own entity, not just 3 of 10;
- I had to change the shape slightly so that they would fit nestled into a box for ease of packing and storage.

So I have bitten the bullet, patented the design and am making a stab at having them produced for sale to schools. I have called them 'Counting Cards'. They may not be the best teaching aid for all students, but they do seem to be very useful for at least some.

I sincerely hope my wife's former difficulty will help other teachers to help students understand this important concept. Only time will tell.

Detailed information on how to use this new aid in the classroom can be found at www.counting-cards.com. They are available from Claire Publications, Unit 8 Tey Brook Crafts Centre, Great Tay, Colchester, Essex CO6 1JE.

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APMC

A. Set out the two numbers as cards, one above the other, on an 'exchange board'.

B. Working from the units side, select and remove 10 units and exchange them for one '10' card, which is placed in the tens column.

C. Select and remove ten '10' cards and replace them with a green '100' card, which is placed in the hundreds column.

D. Students can read the answer as 211. (They can count up all the spots, if they like!)

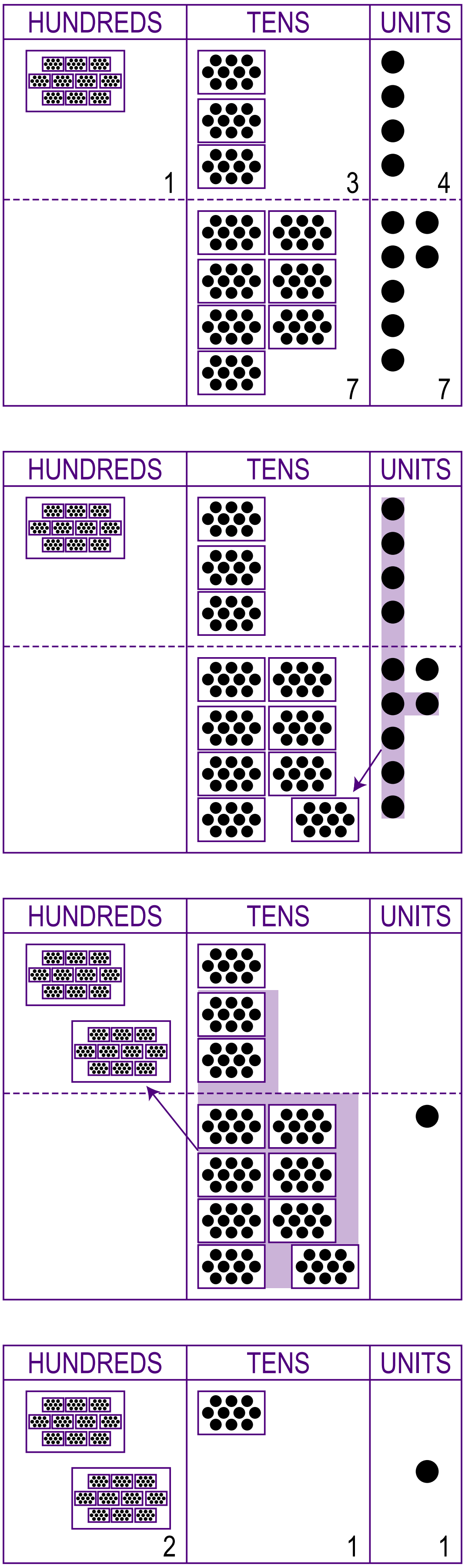

Figure 4. Using the cards to add 134 + 77 with carrying.

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