An attempt at explaining Goldbach's Conjecture

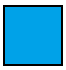
1) CONVENTIONS

- Whenever the word "number" is used loosely in this text, it means a whole number.
- Whenever the word "prime" is used loosely in this text, it means a prime larger than 2.

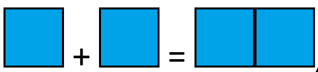
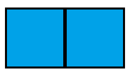
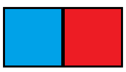
2) ABSTRACT

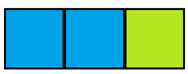
Primes have to be viewed in a slightly different way than the classic "numbers that can only be divided by themselves and 1", as to make clearer the explanation that follows later.

If we imagine that the number 1, our unit in building all whole numbers, is a now a new unit: A square of side 1 (let's call it SU) , and that all subsequent numbers are but constructions made using various amounts of SUs.

1 would be 

,

2 would be 2SU , and I will color each ending SU differently, so that the size of the numbers is clear, so  becomes 

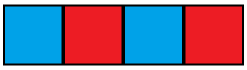
and 3SU would be 

, etc.

Now imagine that after we got to the number 2, we decide we want to build all subsequent numbers without ever using 1 again. That means that number construction will not use SUs as a building block, but can use everything else.

Using 2SUs, our first built would be 4SU (or simply 4, but it is a good idea to think of numbers as blocks for the time being, because these first parts of this discussion involve "building numbers" instead of the more usual methods of processing them, or thinking about them.)

A 4SU (just the number 4 really).



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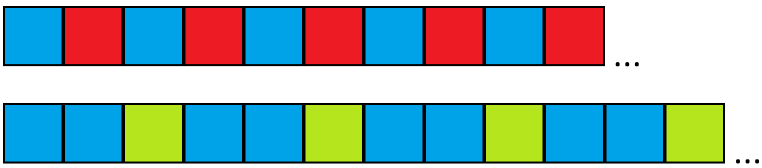
a gap here

Which would leave a gap at 3. Since we need all numbers, to build that number we would have to invent a new building block, 3SU. With the building blocks 2SU and 3SU, we can now have the all the numbers where a 2 (red square) or a 3 (green square) falls:

1 2 3 4 5 6 7 8 9 10



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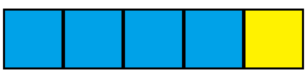
gap

A gap is a square whose column is completely blue (1 SU). The first one we find (excluding the very first one, which is 1) is at 5SU. This would prompt us to create the new 5SU building block.



If we wish (we must!) to represent such a quantity. And so on. Our special way of seeing primes will then be:

Numbers that cannot be constructed by a repetition of building blocks which were themselves made of 1 (or 1 SU).

That is just a different wording for "numbers that can't be divided", but here we see the same phenomenon in a slightly different way: Primes can't be divided by higher building blocks because they were not made of these blocks in the first place.

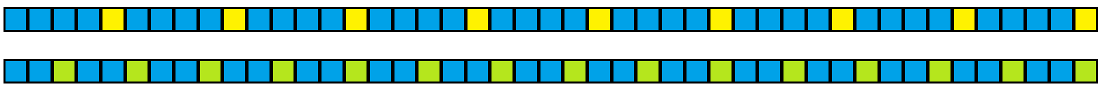
Incidently, we reach upon another proof that there are infinite primes: The "trying to build numbers with any other numbers but 1", states that every "new block" created (2SU, 3SU, etc.) will always start with a blue square (1SU). That one starting blue square of every building block (another name for "prime numbers") is what generates primes. Since for any primes o,p,... we have that the only time their tips will meet is when they are all multiplied by one another, because they cannot be constructed of one another. The square very next to this meeting point of the tips of the primes multiplied will always be a prime number P, because no previous prime can be added to P-1 (the meeting point of all previous primes multiplied) as to create P. The very existence of primes is what creates more primes.

3) AN EQUATION WITH PRIMES

Let's imagine a prime O. Let's call the first prime that occurs after O to P. As an illustration, lets consider 5 and 7.

$5x3^{2=}5+5+5+5+5+5+5+5+5$

If we now construct these 5s using 3s, we know that the final result will have 5 9s or 9 5s. Illustrated we have:



Let's take the upper row, 9 5USs, and compare that with the lower row that has 15 3SUs. Now, If we tried to construct each 5SU in the upper row with 3SUs, but breaking 3SUs if necessary, we have:

First 5 would be: 1 3SU (whole)+ 1 3SU - broken into 2+1. We take the 2 to close our 5, and have 1 remaining:

=

(a whole 3SU) + (a 3SU broken into 2 and 1) . Remainder is , the right tip of the broken 3SU.

Result: 1 whole 3SU + a broken 3SU (into 2 and 1)

Second 5: We already have 1 left over from constructing the first one so, we will need another whole 3SU, and yet another piece of 1 from a freshly broken 3SU

**=**

(left over from previous broken 3SU)+(a whole 3SU)+(a new 3SU broken into 1 + 2). Remainder is

We will write the product 3^2x5 in the following form:

3^2x5=

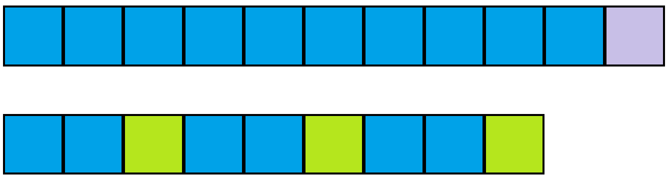
[A whole 3SU + A broken 3SU] +

[Remainder of previously broken 3SU + A whole 3SU + A new broken 3SU (so that we complete a 5SU)] +

...

[Remainder of previously broken 3SU+ A whole 3SU]=45.

In the case of 3 and 5, we need only <u>one</u> 3SU every time we build a 5SU. If we call the 3SU and 5SU in this examples by "small prime" and "big prime" respectively, you will notice that we will need sometimes several "small primes" to build a "big prime", along with the remainders. Look at the case for 3 and 11, where it would take 3 whole 3s (and another broken 3) to build an 11.



What is more interesting for us however, is not constructing a "big prime" with "small primes", but rather constructing "small prime squared" with "big primes". In this case, we would be breaking Ps as to build O^2s.

$O^2 x P=$

$(A \times P)+(O^2 - A \times P)$

(A whole primes P plus broken P needed to fill O^2)

+

$(P - O^2 + A \times P) + (B \times P) + (O^2 - P + O^2 - A \times P)$

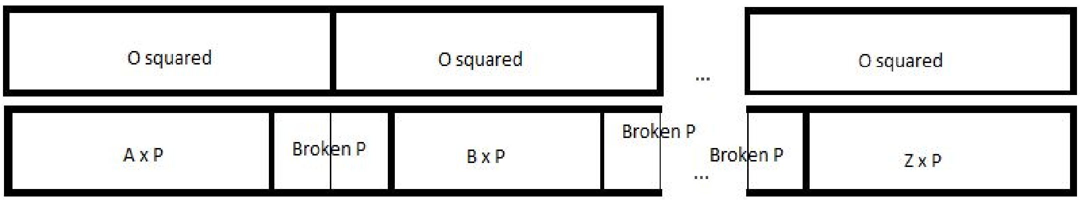
(Remainder of previously broken P + B whole primes P + new broken P)

+

...

+ (unknown remainder P + Z x P)

(Remainder of previously broken P + Z whole primes P)



We noticed that we have a quantity of broken Ps which is always equal to the number of O^2 minus 1. Since we have P O^2, we will have (P-1) broken Ps.To sum up the operations, we will have:

$O^2 x P=A+B+...+Z$ whole Ps+ (P-1) broken Ps

$O^2 \times \cancel{P} = [(A+B+..+Z) \times \cancel{P}] + [(P-1) \times \cancel{P}]$, simplified into $O^2=\sum^{A-Z} + P - 1$

Meaning that we can write any prime as: $P=O^2+1-\sum^{A-Z}$

4) FINALLY

Given an even number 2k, it will be always be possible to represent 2k as the sum of two primes P_1 and P_2 (Goldbach's conjecture).

If that is so:

$2k=P_{1}+P_2$

Since any prime can be written as $O^2+1-\sum^{A-Z}$, we have

$2k=O^2+1-\sum^{A-Z} + M^2+1 + \sum^{\text{ا-ي}}$

We know that O and M are primes, so their squares will be odd numbers. We also know that we have (p-1) broken Ps, which is an even number because P is prime. That means that we will always have an even number of broken primes. Since the total number of broken primes and whole primes is odd, the number of whole primes must be odd, meaning the summations are also odd numbers. Therefore:

an even number 2k= odd+1+odd+odd+1+odd=even alright...

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