On the Concept of Representations of Prime Numbers and Prime Products

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Abstract

The author used to think that the only representation of prime numbers, etc. was the prime number double helix representation. However, in 2011, the author published a paper which puzzled him and it eventually dawned upon him that there was more than one representation of prime numbers. The second representation will be referred to as the hyperbolic representation. The third representation will be called the parabolic representation and is related to the hyperbolic representation. The fourth representation is the triangular representation and is related to the hyperbolic representation. Both of the primary representations, the double helix and the hyperbolic both reject that 2 and 3 are prime numbers. The hyperbolic representation is shown to be related to Lorentz-like transformations.

Keywords: double helix, prime numbers, prime products, 2 and 3 not prime numbers. Lorentz transformation

1. Introduction

The prime numbers and prime products seem to be somewhat of a changeling or perhaps more like the elephant described by the proverbial blind men, each giving an incomplete description by examining the tail, the feet, the trunk, and the ear. The author was puzzled that so many concepts of prime numbers and prime products exist around the world. Whether they are random or form a pattern, do they obey a spiral, wave (Hahn, H. K., 2008), straight line, etc. In order to account for these varied ideas, the author thinks that prime numbers and prime products can be found in many different so-called *representations*. The author thinks that he has found four such representations.

2. The Double Helix Representation (Bissonnet, P., 2006)

The reader is asked to imagine an infinite row, seven column array. Further, imagine that all of the non-prime numbers have been blanked out. One ends up with a set of double lines of prime numbers extending from column 1 to column 6, except for row 1 in which the number 7 is in column 7 (see Fig. 1). The blanked-out cells along the double lines are either simple prime products or multiple prime products. $6s - 1$ (H_1 or helix 1) describes the numbers along the top line, while $6s + 1$ (H_2 or helix 2) describes the numbers along the second line of each pair of lines, with s an integer and $s \geq 1$ (see Table 1). The lines can extend up into column 7, but only the simple and multiple prime products involving 7 will appear. The multiplication rule that is obeyed is the following:

$$(6m + a)(6n + b) = 6r + c \tag{1}$$

where m, n and r are integers ≥ 1, and a, b, and c are +1 or -1. Another rule of the multiplication is that $H_1 \otimes H_1 = H_2 \otimes H_2 = H_2$ and $H_1 \otimes H_2 = H_2 \otimes H_1 = H_1$.

		2	3		5		7
				11		13	
			17		19		
		23					
	29		31				
		37				41	
	43				47		
				53			
			59		61		
				67			
	71		73				
		79				83	
					89		
						97	
			101		103		
		107		109			
	113						
	127				131		
				137		139	
		149		151			
			157				
		163				167	
					173		
				179		181	
		191		193			
	197		199				
	211						
						223	
			227		229		
		233					
	239		241				
						251	
					257		
				263			
			269		271		
				277			
	281		283				
						293	
						307	

Figure 1. Seven column array in which prime numbers and prime products arrange themselves

Table 1. Various values of s used to calculate 6s - 1 and 6s + 1

s	6s - 1	6s + 1
1	5	7
2	11	13
3	17	19
4	23	25 = 5 x 5
5	29	31
6	35 = 5 x 7	37
7	41	43
8	47	49 = 7 x 7
9	53	55 = 5 x 11
10	59	61
11	65 = 5 x 13	67
12	71	73
13	77 = 7 x 11	79
14	83	85 = 5 x 17
15	89	91 = 7 x 13
16	95 = 5 x 19	97
17	101	103
18	107	109
19	113	115 = 5 x 23
20	119 = 7 x 17	121 = 11 x 11

3. The Hyperbolic Representation

The reason as to why this is given the attribute of 'hyperbolic' will be given later in this paper. Consider two integers D and m, with $D > m$, and such that the smallest integer which will allow an equality consistent with $D > m$ is $D \geq m + 1$. If D is an odd number, them m is even and if D is an even number, then m is an odd number. In addition, one or the other of D or m must be divisible by 3, but not both. Now consider numbers P_1 and P_2 defined as:

$$P_1 = D + m \tag{2}$$

$$P_2 = D - m \tag{3}$$

$P_1P_2 = N$ which could be a prime number, a simple prime product, or a multiple prime product

P_1 can be a prime number, a simple prime product, or a multiple prime product.

P_2 can be a prime number, a simple prime product, a multiple prime product, or the identity element 1, as a result of the above $D - m \geq 1$.(The Mathematician, 2010)

Examples are given in following Table 2:

Table 2. Various D and m values for various prime numbers and prime products

D	m	$P_1 = D + m$	$P_2 = D - m$	N
3	2	5	1	5
4	3	7	1	7
13	12	25	1	25 = 5 x 5
9	4	13	5	65
30	11	41	19	779
54	53	107	1	107
12	1	13	11	143
16	3	19	13	247
181	180	361	1	361 = 19 x 19
91	12	103	79	8137
138	11	149	127	18923
194	3	197	191	37627
109	102	211	7	1477
80	63	143 = 11 x 13	17	2431
116	105	221 = 13 x 17	11	2431
2816	2745	5561 = 67 x 83	71	394831
442	225	667 = 29 x 23	217 = 31 x 7	144739
45117	44834	89951 = 293 x 307	283	25456133
41613	41306	82919 = 283 x 293	307	25456133

4. The Parabolic Representation

The parabolic representation is related to the hyperbolic representation.

Consider the equation $y = x^2 - 2Dx + N$, where $N = (D - m)(D + m)$.
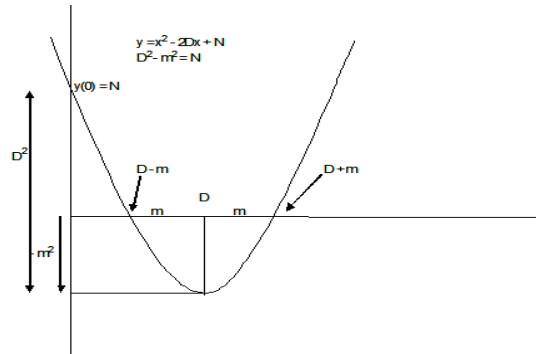

Figure 2. Parabolic representation

This is a parabola with solutions for x at y = 0.

5. The Triangular Representation

Fig. 3 illustrates the essentials below. The line of numbers starting with 25, 36, 49, etc. is referred to by this author as the backbone, with yellow and turquoise ribs extending from it to numbers located in various cells. The numbers in these cells are the values of N (the prime product) for various prime numbers.

The triangular representation is related to the hyperbolic representation. Just as an introduction, (use the zoom function on your computer to view Fig. 3 or click Excel spreadsheet icon), find the number 253 which is the product of 11 and 23. The number 253 sits on top of the dashed line m = 6. The dashed lines represent H_2 or 6s +1, while the solid lines represent H_1 or 6s - 1. Notice how the dashed lines are spaced after every two solid lines, possibly indicating a regularity.
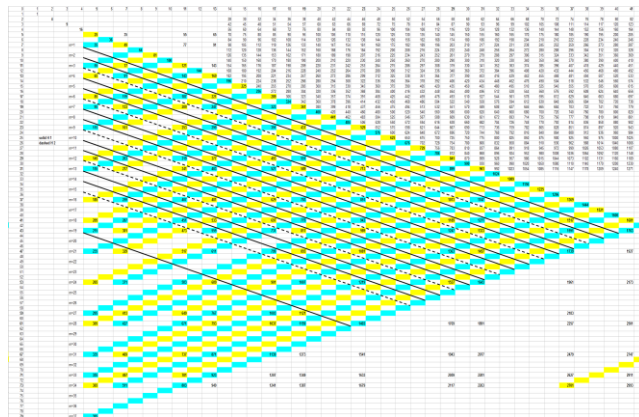

Figure 3. Exhibits relation of m's, H_1, H_2, prime numbers, and prime products
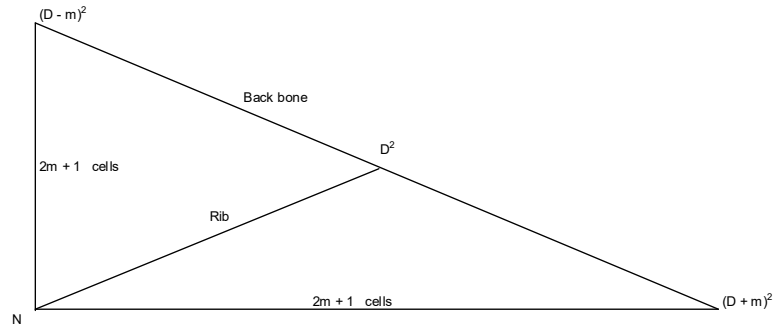
Microsoft Excel
97-2003 Worksheet

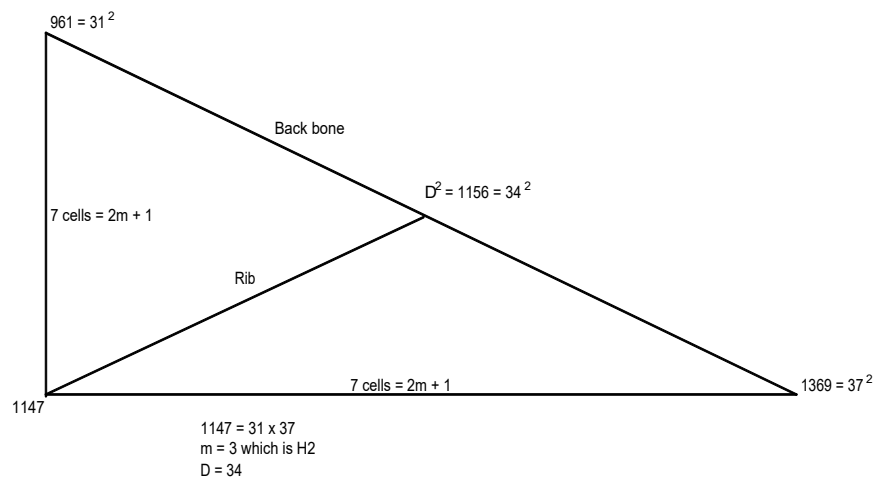Figure 4. Generalized relationship between N, D - m, and D + m in Figure 3
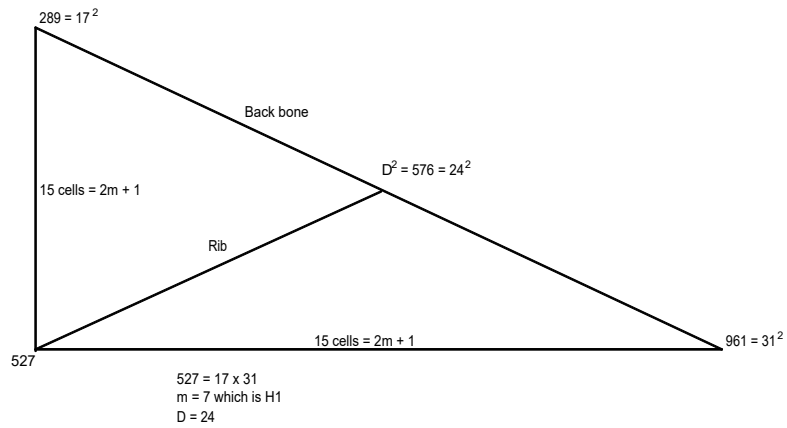
Figure 5. Specific example using N = 1147

Figure 6. Specific example using N = 527

6. Do These Two Primary Representations Have Anything in Common? (Bissonnet, P., 2017)

One notices that the supposed prime numbers 2 and 3 are conspicuously absent from both representations. Let us consider first the hyperbolic representation in order to investigate the products of 2 and 3 with other prime numbers and prime products:

Table 3: Values of D and m using hyperbolic method for numbers 2 and 3

D	m	$P_1 = D + m$	$P_2 = D - m$	N
3/2	1/2	2	1	2
2	1	3	1	3
7/2	3/2	5	2	10
4	1	5	3	15
9/2	5/2	7	2	14
5	2	7	3	21
13/2	9/2	11	2	22
7	4	11	3	33
15/2	11/2	13	2	26
8	5	13	3	39
19/2	15/2	17	2	34
10	7	17	3	51
21/2	17/2	19	2	38
11	8	19	3	57
25/2	21/2	23	2	46
13	10	23	3	69
27/2	23/2	25	2	50
14	11	25	3	75
19	16	35	3	105

It is quite apparent from the above Table 3 that (1) the fractions violate the postulate that D and m are integers and (2) the entries which are indeed integer, one being odd and the other even, violate the postulate that one or the other must be divisible by 3. **Therefore, the hyperbolic representation does not accept that 2 and 3 are prime numbers.**

Let us now consider the double helix representation. The comparison of 2 and 3 with the prime numbers beginning with 5 on Helix 1(H_1) and 7 on Helix 2 (H_2) results in the following short tables of indicators that 2 and 3 are not true prime numbers:

Characteristic 1: Obeys the classical definition of prime numbers?

	2	3	5	7	11	13	17	19	23	31	Etc.
Yes	√	√	√	√	√	√	√	√	√	√	
No											

Characteristic 2: Falls along either one or the other of 6s - 1 or 6s + 1, where $s \geq 1$?

	2	3	5	7	11	13	17	19	23	31	Etc.
Yes			√	√	√	√	√	√	√	√	
No	√	√									

Characteristic 3: Do products of prime numbers fall along 6s - 1 or 6s + 1, where $s \geq 1$?

	2x2	3x3	2x3	2x5	3x5	2x11	3x11	2x7	3x7	2x13	3x13	Etc.
Yes												
No	√	√	√	√	√	√	√	√	√	√	√	

	5x5	7x7	5x7	5x11	7x11	5x13	7x13	11x13	5x17	7x17	17x13	Etc.
Yes	√ H_2	√	√	√ H_1	√	√ H_1	√	√ H_1	√ H_2	√	√ H_1	
No												

It is impossible for 6s - 1 = 2 or 6s + 1 = 2 or 6s - 1 = 3 or 6s + 1 = 3 and at the same time require that s be an integer and satisfying $s \geq 1$. As shown in a previous paper (Bissonnet, P., 2017), s is a composite number which is equal to the sum of two other integers: s = r + n, upon referring to Fig. 1, r is the row number and n is the complex of double lines, the first being n = 0, then n = 1, etc. S is definitely an integer with the minimum value of 1.

Table 4. Shows that s is not an integer for prime numbers multiplied by 2 or 3

N prime number	2N	s in 6s - 1	s in 6s + 1	3N	s in 6s - 1	s in 6s + 1
53	106	17.833	17.500	159	26.667	26.333
101	202	33.833	33.500	303	50.667	50.333
109	218	36.500	36.167	327	54.667	54.333
149	298	49.833	49.500	447	74.667	74.333

157	314	52.500	52.167	471	78.667	78.333
191	382	63.833	63.500	573	95.667	95.333
211	422	70.500	70.167	633	105.667	105.333
241	482	80.500	80.167	723	120.667	120.333
283	566	94.500	94.167	849	141.667	141.333
307	614	102.5	102.167	921	153.667	153.333

Therefore, the double helix representation also rejects 2 and 3 as being true prime numbers.

7. The Logic of 2 and 3 Not Being Prime Numbers

If the double helix representation and the hyperbolic representation are true portals through which to observe prime numbers, simple prime products, and multiple prime products, then is it not a somewhat unsound and circular type of reasoning to assume that 2 and 3 are prime numbers, when such numbers show up in the very definitions/postulates of what is attempting to be proven or ascertained. Namely, the author is referring to the mention of 6 in 6s - 1 and 6s + 1. We know that 6 is 2 times 3. What about the hyperbolic representation, where one of the requirements is that one or the other of D or m must be divisible by 3? The author believes that this is further mounting evidence for 2 and 3 not being true prime numbers.

8. Conclusion (Bissonnet, P., 2011; Bissonnet, P., 2016)

It is very disturbing that both of the primary representations (double helix and hyperbolic) seem to view prime numbers, as well as simple prime products and multiple prime products, on the same or equivalent mathematical footing. It is the dream of mathematicians to somehow separate or filter all prime numbers from the infinite variety of numbers. The current trend is to push further the goal of solving the Riemann Hypothesis. This author sees two very troubling difficulties to this goal; namely, as just stated (1) the seemingly equal mathematical footing given by nature to prime numbers and their products, and (2) the budding recognition (at least by this author) that 2 and 3 are not true prime numbers. In physics, there is a principle that tells an experimenter that there is a limit to how much information he can extract from a system, namely: the *uncertainty principle*. Whether or not there is a similar principle at work in mathematics is unknown, but it pays to be cautious just the same.

The hyperbolic representation was given the name of 'hyperbolic' for two reasons.

(1) Because of the following argument. Consider the form of

$$D^2 - m^2 = N \tag{4}$$

If we divide both sides by N, we obtain

$$\left(\frac{D}{\sqrt{N}}\right)^2 - \left(\frac{m}{\sqrt{N}}\right)^2 = 1 \tag{5}$$

This is an important equation, because we recall from relativity theory the equation

$$x^2 - c^2 t^2 = \pm 1 \tag{6}$$

which represents the calibration hyperbola curves in special relativity. This means that, strangely, the values of $\left(\frac{D}{\sqrt{N}}\right)$

and $\left(\frac{m}{\sqrt{N}}\right)$ transfer to a new set of values $\left(\frac{D'}{\sqrt{N'}}\right)$ and $\left(\frac{m'}{\sqrt{N'}}\right)$

via a set of transformations *similar* to the *Lorentz transformations*, although the β or velocity factor has little meaning. Could this imply that prime products might indicate a way that special relativity can be united with quantum mechanics, since quantum mechanics deals with integers in many instances, and this does seem to exemplify a way that integers

might be connected with the Lorentz transformations.

(2) Let

$$P(x) = D(x) + m(x) \tag{7}$$

$$Q(x) = D(x) - m(x) \tag{8}$$

where

$$D(x) = \sqrt{N}\cosh x \tag{9}$$

$$m(x) = \sqrt{N}\sinh x \tag{10}$$

where cosh x and sinh x are hyperbolic cosine and sine respectively.

As a result of equation 4, we arrive at a geometric identity

$$\cosh^2(x) - \sinh^2(x) = 1 \tag{11}$$

Consequently, we have the following conjecture:

Conjecture:

There is one and only one x = x_0 (not necessarily an integer) which causes <u>both</u> D(x_o) and m(x_o) to simultaneously assume integer status. In other words, sin D (x_o) π = 0 and sin m (x_o) π = 0.

Let us do some further supposing. To give a visual representation of equal mathematical footing, let us suppose that prime numbers can be represented by small green balls of a given diameter and weight. Suppose that simple prime products can also be represented by small green balls of the same color, diameter, and weight. The same for multiple prime products. How, then, can one form a sieve to sift out the prime numbers from the rest? Let us further suppose that the real physical world is built upon prime numbers, simple prime products, and multiple prime products. Consider that nature is as confused as we are in trying to separate prime numbers from the rest of the prime products and therefore exhibits an indeterminancy, delay, or whatever you want to call it in reaching a physical state. Could this not be considered an uncertainty? Could the uncertainty principle be considered the result of the mathematical equivalency of prime numbers, simple prime products, and multiple prime products in this type of physical world or physical reality; hence, the rudimentary genesis of quantum mechanical waves. Couple this with the relation of prime products with the Lorentz-like transformations, and we possibly have a way to unite special relativity and quantum mechanics. Quite a thought, isn't it?

From another point of view, let us reconsider a possible meaning of equal mathematical footing of prime numbers, simple prime products and multiple prime products in a physical reality built upon same. Consider the above green balls, which are indistinguishable, and which seemingly have no aversion to congregating together. Isn't this reminiscent of a class of particles called bosons? By the way, the author has no dislike for the numbers 2 or 3. If 2 or 3 do not represent prime numbers, where could they fit in? Possibly 2 finds an exposition in two groups of particles called spin ½ fermions and spin 2 gravitons. Possibly 3 finds an exposition in a triangular class of particles called quarks with charges of +2/3, +2/3 and -1/3 the charge of the electron.

Acknowledgments

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