Generation of Exact and Complete Pattern of Prime Numbers vs. Composite Numbers as Anticipating and Computational Prime Numbering System

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Abstract
A mathematical deduction of formulas generating the exact and complete pattern of prime numbers vs. composite numbers, was presented in the treatment by Johansen (2010a). We recapitulate some key points from this treatise. Then we explain how said pattern, which also has a *geometric* anchoring and representation, is established in the *maximum* sense of a pattern, manifesting from a certain disclosed number *generator*. It is also demonstrated how this maximum pattern can be represented as an achieved *computational* expression and translation. Finally, it is discussed in what regards the prime numbering system can be interpreted as *anticipatory* from the mathematical and computational expressions of this system.
Keywords: number theory, distribution of primes, pattern in primes, Johansen Revolving Prime Number Code, computational anticipating systems.

I think completely new ideas are required to solve the next huge mathematical enigma. It is the question whether there exists a pattern for when the prime numbers appear.
John Terrence Tate (2010)

1 Introduction

We recapitulate several key points from the treatise Johansen (2010a) in some detail in order to specify and discuss implications of these mathematical results with regard to pattern interpretation, computation and anticipatory systems. This treatment applies a certain *geometrical* interpretation of the natural numbers, where these numbers appear as *joint products of 5- and 3-multiples* located at specified *positions* in a *revolving chamber*.

Numbers without factors 2, 3 or 5 appear at *eight* such positions, and any prime number larger than 5 manifests at one of these eight positions after a specified amount of rotations of the chamber. Our approach determines the sets of rotations constituting *primes* at the respective eight positions, as the *complements* of the sets of rotations constituting *composite numbers* at the respective eight positions. These sets of rotations constituting composite numbers are exhibited from a *basic 8×8-matrix* of the *mutual* *products* originating from the eight prime numbers located at the eight positions in the *original* chamber. This 8×8-matrix generates *all* composite numbers located at the eight positions in *strict rotation regularities* of the chamber. These regularities are expressed in relation to the multiple 11^2 as an anchoring *reference point.* Rotations generating *all* composite numbers located at *same* position in the chamber are expressed as a set of *eight related series*. The *total* set of composite numbers located at the eight positions is exposed as *eight* such sets of eight series, and with each of the series *completely* characterized by *four simple variables* when compared to a reference series anchored in 11^2. This represents a *complete* exposition of composite numbers generated by a quite simple mathematical structure. *Indirectly* this also represents a *complete* exposition of all *prime numbers* as the union of the eight complement sets for these eight non-prime sets of eight series. By this an exact and a complete *pattern* of composite numbers, as well as of prime numbers, is deduced and exhibited from a certain exposed number *generator*.

Johansen (2012) offers some short presentation of previous mathematical research leading in *direction* towards discovery of an exact as well as complete pattern of prime numbers vs. composite numbers.

2 Revolving Generation of Complete and Exact Pattern of Composite Numbers vs. Prime Numbers

We start out from a rewrite of natural numbers as combined multiples of the numbers 5 and 3:

(1) $N = m5 + n3; \quad m>0, n>0$

Obviously, this split code 5:3 can be performed to cover *any* sequence of integers by simply lowering the bottom values of m and n.

The profound significance of the split code 5:3 in *Nature's code* (Rowlands) is acknowledged and argued in the pioneering, monumental work of Peter Rowlands (2007), and also with some stated connection (Rowlands 2007: 530, 550) to the initial contribution by Johansen (2006). (Recently, reinforcement of said significance has been established from the group representation of the results of Johansen (2010a), achieved by Strand (2011). Even more recently, the significance of the split code 5:3 has become further supported and qualified from results presented in the treatise of Johansen (2011), especially due to the revealed algorithm for Fibonacci-Pascal distribution of Zeckendorf summands, which generates "the basic law of cybernetics, informatics and synergetics for complex systems" (Ignatyev 2006; cf. also Johansen 2010b).

From (1) we construct the following matrix:

3 \ 5	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	.. m
1	8	13	18	23	28	33	38	43	48	53	58	63	68	73	78	83	88	93	
2	11	16	21	26	31	36	41	46	51	56	61	66	71	76	81	86	91	96	
3	14	19	24	29	34	39	44	49	54	59	64	69	74	79	84	89	94	99	
4	17	22	27	32	37	42	47	52	57	62	67	72	77	82	87	92	97	102	
5	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	
6	23	28	33	38	43	48	53	58	63	68	73	78	83	88	93	98	103		
7	26	31	36	41	46	51													
8	29	34	39	44	49	54													
9	32	37	42	47	52	57													
10	35	40	45	50	55	60													
11	38	43	48																
12	41	46	51																
:																			
n																			

Figure 1: The Revolving Chamber

There exist three possibilities to make a cut in the matrix in such a way that every number shows up only once. We denote these three bands of numbers by means of colour terms:

1) *The Blue Band*, corresponding to the five upper rows.
2) *The Red Band*, corresponding to the three left columns.
3) *The Violet Band*, corresponding to a double diagonal field unfolding from first six columns of The Blue Band, or from first ten rows of The Red Band.

There can not be any prime numbers in the row for n=5, nor in the columns that are multiples of m=3. Ignoring these rows and columns (illustrated by the black grid in fig. 1), prime candidates can only appear in the remaining "chambers" of the bands. Further, prime candidates can only appear at spots in the chambers where *odd* numbers are located (illustrated with the colours blue, red and violet, respectively). We notice that these spots are distributed in a zigzag pattern inside each chamber, and that this pattern alternates with its mirror pattern when progressing horizontally or vertically along a band. In the present context we will only study The Blue Band.

We apply the notion '*original chamber*' to denote the location of the first eight prime numbers in The Blue Band, not situated at black frames, at the (upper) left segment of fig. 1, i.e. the eight primes from 11 to 37. This original chamber is divided into its *left* (sub-)chamber, primes 11,13,17,19; and its *right* (sub-)chamber, primes 23,29,31,37. Then we imagine this left chamber *revolving in 3D* around the black vertical axis made up of the numbers 18,21,24,27,30. After *half* a rotation the four positions of the primes in the left chamber will cover the four positions of their respective enantimorphs in the right chamber, i.e. as 13 onto 23, 11 onto 31, 19 onto 29, and 17 onto 37. After a *whole* rotation, the four positions of the primes in the *left* chamber will cover the four positions of the corresponding numbers in the *left* (sub-)chamber of the *second* chamber in The

Blue Band, the chamber to the *right* of the original chamber, i.e. as 13 onto 43, 11 onto 41, 19 onto 49, and 17 onto 47. After a whole rotation of the four positions of the primes in the *right* (original) (sub-)chamber, these positions will cover the four positions of the corresponding numbers in the *right* (sub-)chamber of the second chamber in The Blue Band, i.e. as 23 onto 53, 31 onto 61, 29 onto 59, and 37 onto 67. Hence, taken together, after a whole rotation of the *eight* positions of the primes in the original chamber, these eight positions will cover the eight positions of the corresponding numbers in the second chamber, and each of these last eight numbers is determined as the number at the corresponding position in the original chamber, *added with 30*. Obviously, after *multiple* rotations of the original chamber, the number in the arrival chamber is determined as the number at the corresponding position in the original chamber, added with the *same multiple of 30.* Also obviously, *any* odd number in the blue band is determined uniquely and can be written uniquely as the corresponding position in the original chamber, undergoing a *certain multiple of whole rotations*, which corresponds to the original number being added with the same multiple of 30. Hence, the eight positions of primes in the original chamber determine *uniquely and exhaustively all* odd numbers in chambers of The Blue Band when undergoing *all* possible integer multiples of whole rotations, which is equivalent to each of the original eight numbers being added with all corresponding integer multiples of 30.

To easily get a picture of the underlying prime number generator, we first imagine *all* remaining odd (blue) numbers in The Blue Band as being prime numbers. This is the case for the first two chambers of The Blue Band. However, in the third chamber, which can be imagined as constituted from the first (whole) *rotation* of the left, first chamber, the number 49, i.e. 7×7, shows up as the first anomaly not being any prime number. Analogous anomalies will be the case for all powers of 7, as well as for all "clean multiples" of 7 (meaning those having a factor in a preceding chamber) located in chambers further to the right on The Blue Band. 7 is the only lower number *outside* and *before* our matrix, which acts as a "bullet" and "shoots out" odd numbers in The Blue Band, removing their prime number candidature. For example, the number 77 is shot out from the prime number universe in chamber no. 5 after two rotations of chamber no. 1, being a multiple of the bullets 7 and 11. Prime numbers from the first chamber will deliver the same "ammunition" when exposed for sufficient rotations to manifest multiples made up as internal *products* of these prime numbers. Such multiples occur at corresponding "arrival spots" in upcoming chambers after further rotations. For example, the number of 143 is shot out from the prime number universe in chamber no. 10 after four rotations of chamber no. 2, being a multiple of the factor "bullets" 11 and 13. Quite obviously, *all* multiples of primes will expose the same pattern of shooting out corresponding prime number candidates occurring in proceeding chambers, without regard to the number of rotations of chamber no. 1 or no. 2 manifesting the prime factor bullets of the multiple. Hence, the over-all process of shooting out prime candidates can be imagined as successive out-shooting during consecutive rotation of chambers no. 1 and 2, due to more and more multiples from prime bullets, located in preceding chambers, becoming manifest along with further chamber rotations. This elimination process of prime candidates is obviously *exhaustive*. *All* prime candidates which are *not* shot out from the multiples of prime bullets occurring at preceding chambers *have* to be primes. Therefore, a complete mathematical description of this successive out-shooting of prime candidates will automatically *ad negativo* implicate also a complete, successive description of the generation of prime numbers. Here the prime numbers appear as the numbers *remaining* in chambers of The Blue Band *after* the shoot-out procedure has passed through the chamber where the prime candidate is located.

The model of fig.1, as well as the general procedure of shooting out prime candidates, was presented in Johansen (2006: 127-9). The deduction of complete formulas to perform the out-shooting, according to this approach, in order to generate prime numbers exactly and completely was presented in Johansen (2010a). Here we will recapitulate some crucial steps, notions and figures from this deduction.

We apply the following notation of the blue (odd) numbers' positions inside a chamber, using their positions inside the first two chambers as illustration:

Left chamber: a_1: position of 13; a_2: position of 11; a_3: position of 19; a_4: position of 17.

Right chamber: b_1: position of 23; b_2: position of 31; b_3: position of 29; b_4: position of 37.

Number position

	Left chamber				Right chamber			
	a_1	a_2	a_3	a_4	b_1	b_2	b_3	b_4
Start:	13	11	19	17	23	31	29	37
Step								
1			13- 5(13) 17- 9(17) 23-17(23) 37-45(37)			11- 3(11) 19-11(19) 29-27(29) 31-31(31)		
2		13- 7(17)		19-14(23) 37-50(41)	11- 4(13) 17-10(19)		29-29(31)	23-21(29) 31-37(37)
3		19-18(29) 31-42(41)			23-23(31) 29-35(37)	17-12(23) 37-52(43)		11- 5(17) 13- 7(19)
4	17-16(29) 31-44(43)	23-28(37)	19-19(31) 29-39(41)				11- 6(19) 13- 9(23) 37-57(47)	
5	11- 8(23) 19-23(37) 23-31(48) 37-60(49)			13-12(29) 17-17(31) 29-41(43) 31-48(47)				
6	13-13(31) 29-45(47)	37-65(53)	11-10(29) 31-50(49)				17-20(37) 19-25(41) 23-32(43)	
7		11-11(31) 29-47(49)			31-54(53) 37-72(59)	13-15(37) 23-35(47)		17-22(41) 19-26(43)
8		17-24(43)		11-13(37) 23-37(49)	13-17(41) 19-29(47)		31-60(59)	29-50(53) 37-74(61)

Figure 2: The basic 8×8-matrix of the non-primes generator in the revolving chamber

Then, all blue numbers in The Blue Band can be written as one of these positions combined with a specific number of rotations. As an example, 71 can be written as [2,a_2], *meaning* that 71 emerges at the position a_2 after 2 rotations of the original (left) chamber. Accordingly, 67 will be written as [1,b_4], etc.

Fig. 2 describes the basic distributive structure of positions (illustrated as columns) in the chambers, manifesting from the specific numbers of rotations (illustrated in red) of the eight initial position numbers (illustrated in bold black) of the original chamber (i.e. chamber no.1, the left, and chamber no.2, the right, taken together), where these rotations correspond to stepwise multiplications of the respective original position numbers with progressively larger multiplicators (illustrated in blue). The succession of multiplications goes as follows, taking as example 11 as multiplicand:

Table 1: MULTIPLICATOR	VS.	PRODUCT - POSITION - ROTATIONS
1. row: the multiplicand number itself.		11×11 at b_2 after 3 rotations
2. row: the closest blue number larger than itself.		11×13 at b_1 after 4 rotations
3. row: the 2. closest number larger than itself.		11×17 at b_4 after 5 rotations
4. row: the 3.	"	11×19 at b_3 after 6 rotations
5. row: the 4.	"	11×23 at a_1 after 8 rotations
6. row: the 5.	"	11×29 at a_3 after 10 rotations
7. row: the 6.	"	11×31 at a_2 after 11 rotations
8. row: the 7.	"	11×37 at a_4 after 13 rotations
9. row: the 8.	"	$11\times(11+30)$ at b_2 after (3+11) rotations
10.row: the 9.	"	$11\times(13+30)$ at b_1 after (4+11) rotations
11.row: the10.	"	$11\times(17+30)$ at b_4 after (5+11) rotations
…………….....	….	………………………… ……………

As an example we can look at the number in the box [8,b_3] that manifests at position b_3, i.e. the same position as 29 in the original chamber, after the original number 31 is multiplied with the multiplicator 59 which is situated at the 8. row, i.e. 7 steps after the number 31 itself acts as multiplicator on itself. This box is reached after 60 rotations of the original chamber.

For each of the eight different position numbers in the original chamber, the position of the multiplicand's product in the 9. row (i.e. after 8 steps of the succession) is identical with the original position, the position of the multiplicand's product in the 10. row (i.e. after 8+1 steps of the succession) is identical with the original position, etc.

This means that with respect to *position*, the 8 sequence of positions characteristic for the products progressing in steps from the original position for the smallest considered product of the respective multiplicands, just repeats in 8 steps cycles along with increasing additions of 30s to the multiplicator. (From now on we denote the number of such 30-additions with the symbol *m*.)

With regard to the number of *rotations*, we always have that after 8 steps the number of rotations added to the rotations in the product in row 1, required to manifest the product for the same multiplicand in 9. row, is identical to the size of the multiplicand. Thus, as an example, for the multiplicand 11, the product in 9. row is reached as the 3 added rotations of its initial product in row 1, added with 11 new rotations, which gives 14 rotations. And the same must be the case with respect to the added numbers of rotations stepping from 2. row to 10., from 3. row to 11. row, etc.

The same homology with respect to position and rotations occur for additions of 30s to the *multiplicand* (denoted with the symbol *n*).

Thus, all thinkable products (besides the trivial products of 2, 3 and 5, and the not so trivial products of 7) can be written uniquely as the square of one of the multiplicands located in the original chamber, successively added with increases in m and increases in n. Any of these products arrives in one of the 64 boxes of fig. 2, after a specified number of rotations, completely determined by the position and number of rotations of the initial squared product, and the sizes of m and n. If we, as an example, consider products arriving in box [3, b_4], the non-primes entering this box from the total *11-path*, are given by the set:

(3) (11+n30) [(17+n30) +m30]

alternatively expressed as:

(3b) 37 + 30[5+ n(11+17) +m11 +n30(n+m)]

Non-primes entering this box from the total *13-path*, are given by the set:

(4) (13+n30) [(19+n30) +m30]

alternatively expressed as:

(4b) 37 + 30[7+ n(13+19) +m13 +n30(n+m)]

Products generated from the multiplicand 7 constitutes a special case that is covered by being represented by n=-1 in analogous expressions for boxes reached from the total 37-path. With regard to *positions* the path from 7 is identical to the path from 37; thus the two paths only differ with respect to the number of *rotations*. 37 is chosen instead of 7 as an original position number due to completing the original chamber in fig. 1 with a symmetrical structure between left and right chamber.

The expressions for the 64 boxes of products, developed in analogy to (3) and (4), can be rewritten as *additives* of rotations compared to the rotations of products arriving in box [1, b_1] as an anchoring box suitable as a general reference. We rewrite this reference box to box (11,11) which denotes all products arriving in the same position in fig. 2 from successive increases of m and n to the initial product 11×11 arriving in this box.

Horizontally, at the top of fig. 3, we list in succession the factors in the original chamber, acting as *multiplicands* in the 64 basic products represented in fig. 2. Vertically, to the left of fig. 3, we list in succession the numbers acting as *multiplicators* in the 64 basic products represented in fig. 2. Hence, all the 64 basic products, and all the clusters of non-primes generated from each of them, are also represented in fig. 3. The amount of rotations for the initial product in each box (i.e. for m=0 and n=0) is displayed in red in fig. 3, and the position number where products arrive (i.e. the columns of fig. 2) is displayed in black to the right of these numbers in red. Hence, fig.

3 displays the 64 boxes of products distributed among these 8 position numbers where the respective boxes arrive, as specified expressions of n- and m-additives of rotations compared to the reference box (11,11).

	11	**13**	**17**	**19**	**23**	**29**	**31**	**37**
11	0n 3-31							
13	2n 4-23	2n +2(m+n) 5-19						
17	6n 5-37	6n+2(m+n) 7-11	6n+6(m+n) 9-19					
19	8n 6-29	8n+2(m+n) 7-37	8n+6(m+n) 10-23	8n+8(m+n) 11-31				
23	12n 8-13	12n+2(m+n) 9-29	12n+6(m+n) 12-31	12n+8(m+n) 14-17	12n+12(m+n) 17-19			
29	18n 10-19	18n+2(m+n) 12-17	18n+6(m+n) 16-13	18n+8(m+n) 18-11	18n+12(m+n) 21-37	18n+18(m+n) 27-31		
31	20n 11-11	20n+2(m+n) 13-13	20n+6(m+n) 17-17	20n+8(m+n) 19-19	20n+12(m+n) 23-23	20n+18(m+n) 29-29	20n+20(m+n) 31-31	
37	26n 13-17	26n+2(m+n) 15-31	26n+6(m+n) 20-29	26n+8(m+n) 23-13	26n+12(m+n) 28-11	26n+18(m+n) 35-23	26n+20(m+n) 37-37	26n+26(m+n) 45-19
41		30n+2(m+n) 17-23	30n+6(m+n) 22-37	30n+8(m+n) 25-29	30n+12(m+n) 31-13	30n+18(m+n) 39-19	30n+20(m+n) 42-11	30n+26(m+n) 50-17
43			32n+6(m+n) 24-11	32n+8(m+n) 26-37	32n+12(m+n) 32-29	32n+18(m+n) 41-17	32n+20(m+n) 44-13	32n+26(m+n) 52-31
47				36n+8(m+n) 29-23	36n+12(m+n) 35-31	36n+18(m+n) 45-13	36n+20(m+n) 48-17	36n+26(m+n) 57-29
49					38n+12(m+n) 37-17	38n+18(m+n) 47-11	38n+20(m+n) 50-19	38n+26(m+n) 60-13
53						42n+18(m+n) 50-37	42n+20(m+n) 54-23	42n+26(m+n) 65-11
59							48n+20(m+n) 60-29	48n+26(m+n) 72-23
61								50n+26(m+n) 74-37

Rotations for the platform for the additives; the reference box (11,11) is:
3 + 11n + 11(m+n) + n30(m+n)

Figure 3: The 8×8 universal matrix of (11,11)-related additives of rotations for complete generation of non-primes © Stein E. Johansen

The different amounts of rotations making up the complete set of products arriving in the reference box (11,11) can be displayed as the following series:

```
    3+                        0+
    3+                      1+
    3+                    2+   1
    3+                  3+   2
    3+                4+   3 + 1
    3+              5+   4 + 2
    3+            6+   5 + 3 + 1
    3+          7+   6 + 4 + 2
    3+        8+   7 + 5 + 3 + 1
    3+      9+   8 + 6 + 4 + 2
    3+    10+  9 + 7 + 5 + 3 + 1
    3+  11+  10+ 8 + 6 + 4 + 2
    ...   ...   ...................
    ....  ....  ...................
n       0      1  2  3  4  5
```

Colour coding:
30's
11's
1's

Figure 4: Make-up of the set of rotations for non-prime box (11,11) at position number 31 in the revolving chamber © Stein E. Johansen

In fig. 4 the position of each number signifies a unique product. As an example: The amount of rotations represented by the black **4** at the row with blue 9 in the figure, is:

(5) $3+ 11\times 9 + 30(8+6+\mathbf{4}) = 642$

The natural number corresponding to this place in the revolving chamber after this amount of rotations:

(6) $642\times 30 + 31 = 19291$

Hence, this black 4 in fig. 4, when interpreted in this manner, is just another way of writing the number 19291. Since this number is included in fig. 4, it is positioned in box (11,11) and with necessity a non-prime. Just for confirmation: This black 4 is located in fig. 5 at the position for the row indicated by the blue number, $n+(m+n)=9$, and the diagonal $n=3$. This gives the factor $(11+3\times 30)$ from the value of n, and from the value of m the other factor $[(11+3\times 30) + 3\times 30]$, i.e. the product 101×191 which is 19291.

The pattern in fig. 4 generating all products arriving in box (11,11) is amazingly simple. The series generating all products arriving in the remaining 63 boxes show to be modified variations built on the same basic pattern.

One of these variations is illustrated in fig. 5.

```
3+4+                              0+0
3+4+                           1+1
3+4+                        2+2  +   1+3
3+4+                     3+3  +   2+3
3+4+                  4+4  +   3+3 + 1+3
3+4+               5+5  +   4+3  + 2+3
3+4+            6+6  +   5+3  + 3+3  + 1+3
3+4+         7+7  +   6+3 + 4+3  + 2+3
3+4+      8+8  +   7+3  + 5+3  + 3+3 + 1+3
3+4+   9+9  +   8+3  + 6+3 + 4+3 + 2+3
3+4+    10+10 +   9+3 + 7+3  + 5+3  + 3+3 + 1+3
3+4+  11+11  +  10+3 + 8+3 +  6+3 + 4+3 + 2+3
.....   ..................................................
.....   ..................................................
n        0    1    2    3    4    5
```

Colour coding: **30's 11's** 2's 2's 1's

Figure 5: Make-up of the set of rotations for non-prime box (19,13) at position number 37 in the revolving chamber © Stein E. Johansen

For the remaining boxes the modifications of the basic pattern exposed by fig. 4 appear only moderately more complex than the modification represented by fig. 5. Each of the 64 patterns, with corresponding series, can be *completely* characterized by *four simple variables* when compared to the reference series displayed in fig. 4 anchored in 11^2. The values of these four simple variables for the respective 64 boxes are calculated and listed in expressions (69) and (73a-g) in Johansen (2010a). By this the expressions of rotations generating *all* composite numbers located at *same* position in the chamber is found as a set of *eight related series*. Hence, the *total* set of composite numbers located at the eight positions is exposed as *eight* such sets of eight series. This represents a *complete* exposition of composite numbers generated by a quite simple mathematical structure. *Ad negativo* this also represents a *complete* exposition of all *prime numbers* as the union of the eight complement sets for these eight non-prime sets of eight series.

3 Informational Discussion of the Exposed Pattern of Prime Numbers vs. Composite Numbers

Any aggregate of events or objects (-) shall be said to contain (-) "pattern" if the aggregate can be divided in any way by a "slash mark", such that an observer perceiving only what is on one side of the slash mark can ***guess****, with better than random success, what is on the other hand of the slash mark. We may say that what is on one side of the slash contains* ***information*** *or has* ***meaning*** *about what is on the other side.* (Bateson 1972: 131)

Thus, when performing a cut in a constrained appearance of information, the Bateson criterion for a pattern is that it is possible from the information residing at one side of the cut to predict *some* information residing at the other side of the cut with *more than random* probability. This can be said to constitute the criterion for a *minimal* pattern, in binary opposition to the criterion for a *maximal* pattern defined from the criterion of being able to predict with *zero* randomness *all* information residing at the other side. In natural science a maximal pattern can be confirmed *a posteriori* from a good hypothesis for a natural system, running for a specified and constrained time, but never *a priori*. An *a priori maximal* pattern, not dependent on confirmation from empirical observation, is only possible from *deduction* performed by formal science from *axioms* in distinction to *hypotheses*. In any case the very notion of pattern presupposes the notion of prediction (whether guessing, or performed with certainty) which, in its turn, presupposes the notion of *anticipation*.

```
2      x x x x x x x x x x x x x x x x x x x x x x x x x x x x x
3       x  x  x  x  x  x  x  x  x  x  x  x  x  x  x  x  x  x  x
5         x    x    x    x    x    x    x    x    x    x    x
Total  xxxxx0xxx0x0xxx0x0xxx0xxxxx0x0xxxxx0xxx0x0xxx0x0xxx0xxxxx
Gap numbers 7   11 13 17 19  23   29 31   37  41 43 47 49  53
```

Figure 6: What is a pattern?

Trivially, the exact and complete occurrences of the multiples of 2 can be predicted from the information before a cut after 2×2, and the same holds for the multiples of 3 as predicted from the information before a cut after 3×2, and for the multiples of 5 as predicted from the information before a cut after 2×5. Hence, all these three cases unveil *maximal* patterns. Also trivially, the exact and complete occurrences of multiples having 2, 3 *or* 5 as a factor, can be predicted from the information before the last cut. Hence, this case also unveils a maximal pattern. Obviously, as illustrated in fig. 6, such a maximal pattern automatically implies a corresponding prediction of the exact and complete occurrences of the *gaps*, i.e. the *absent* information, in the positive over-all pattern, by simply performing the switch from the positive pattern to its *negative gestalt*. Also obviously, the same must be the case whatever the mathematical complexity of the positive pattern. Since our deductive exhibition in Johansen (2010a) represents a prediction of the exact and complete occurrences of composite numbers after an initial cut, performing the gestalt switch from this positive pattern to the prediction of the exact and complete occurrences of *gaps* between composite numbers, i.e. the prime numbers, must also represent a maximum pattern.

We may illustrate this with an analogy to the keys on a piano:

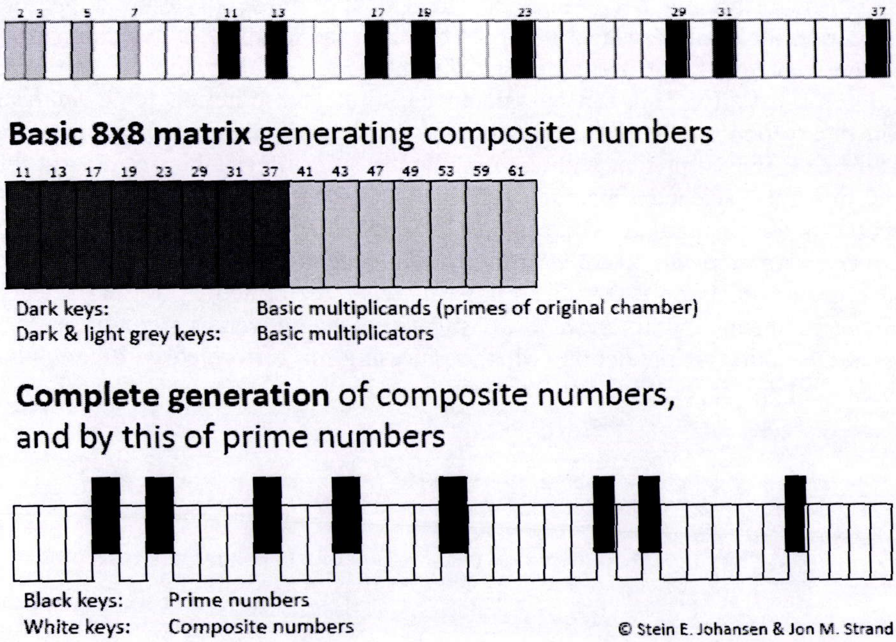

Figure 7: The Piano Analogy

The cut for contemplating the pattern is represented by the eight prime numbers in our original chamber. From these eight number positions, the occurrences of the eight basic multiplicators for the respective eight multiplicands are predicted with zero randomness. This constitutes the self-referential basic matrix of products displayed in fig. 2, from which all other composite numbers are deduced and predicted with zero randomness. More precisely, that is when we already presuppose the trivial maximum pattern of composite numbers with factors 2, 3 or 5 (easily predicted with zero randomness from the original chamber), and treat the multiplicand 7 as a negative rotation of 37 (which in our analogy may be thought somewhat similar to the little left finger hitting the key one octave lower from the black key 37). Thus, the exact and complete occurrences of all composite numbers are predicted with zero randomness from the cut after the first chamber, and the exact and complete occurrences of non-trivial composite numbers are predicted with zero randomness from the eight prime numbers in the original chamber. This may be compared to a pianist touching eight black keys at the left of the piano with his hands and from there touching all remaining white keys in succession in one sweeping movement. The keys he does not touch, is then the totality of black keys after the first eight ones, corresponding to the gaps representing the prime numbers. By simply performing the gestalt switch, our deduction of a maximal pattern also represents an exact and complete prediction of all non-trivial prime numbers, i.e. a deduction of a *maximal* pattern of *prime numbers* from the cut after the eight prime numbers in the original chamber.

To our knowledge such a maximal pattern of prime numbers has never previously been discovered – not to say: deduced – in mathematics. There exist many *computational* methods to find prime numbers, but these move to and from and forwards and backwards between prime numbers and composite numbers. Hence, they do not establish any *cut* where prime numbers (or composite numbers) are predicted *independently* (to the complementary class of natural numbers; i.e. either composite numbers or prime numbers, respectively), exactly, completely and irreversibly from *one* side of the cut *to the other*. Thus, such methods are of course able to *find* the primes, but without knowledge or claim of any *pattern* existing in the primes.

In an interview with the Norwegian newspaper *Dagens Næringsliv*, May 25, 2010, Abel prize winner John Terrence Tate, who "received his prize for researching prime numbers and whether there is any pattern in how often primes occur", was quoted as follows (Tate 2010): "I think completely new ideas are required to solve the next huge mathematical enigma. It is the question whether there exists a pattern for when the prime numbers appear." (Our translation from Norwegian: "Jeg tror det må helt nye ideer til for å løse den neste store matematiske gåten, sier han. Den dreier seg om hvorvidt det fins et mønster for når primtallene dukker opp.")

The meaning of 'pattern' in the last quote is not immediately transparent (and obviously different from the weaker meaning in the first quote). For example, the well known *Ulam spiral* represented a weak pattern for occurences of prime numbers, confirmed as more than random by observations of whether increasing primes occur at the spiral trajectory. However, this pattern was evidently far from maximal, and it was spotted *without* being established – nor, of course, proven – by any mathematical deduction, so obviously Tate had a stronger and more maximal pattern in mind.

Our exhibition, presented in the treatment of Johansen (2010a), represented a *deduction* of such a pattern a priori, *exactly* and *completely* in the *maximal* sense of a pattern, and this was achieved from unveiling the number *generator* of said pattern.

4 Computational Expression of the Exposed Pattern of Prime Numbers vs. Composite Numbers

From the formulation and structure of the 8×8 series it appeared obvious that this maximal pattern also was computational. Jon M. Strand (cf. *appendix*) has expressed these mathematical series in a data program yielding a successive listing of prime numbers, whatever the upper limit of natural numbers (presupposing sufficient computer capacity available). This was achieved by a remarkably simple software formulation, only employing 29 lines of code as its main part (the "bow" part of the *appendix*). When inspecting the program we may notice some creative translation from the mathematical formulas to the software expressions, indicating that the path from formulas to algorithms, and – in general – from mathematics to informatics, may require a creative "interfacing" to discover adequate and convenient algorithms to express the formulas. In any case the present software obviously represents the deduced formulas in a 1:1-manner, which also have been confirmed by all running trials. Thus, whether the *Johansen Revolving Prime Number Code*, as exhibited in Johansen (2010a), is expressed as mathematical formulas vs. as translated to software algorithms, does not make any difference with respect to the fact that both expressions represent a *maximal* pattern.

5 Discussion of the Exposed Pattern as Anticipating Prime Numbering System

As noted by Dubois, "the word program, comes from 'pro-gram' meaning 'to write *before*' by *anticipation*", whether as plans, as inserts or as parts, into mechanisms or organisms (Dubois 2010: 23). Leaving out possible implementations of the prime numbering system, understood as the *Johansen Revolving Prime Number Code*, into mechanisms or organisms of natural systems, it is evident that this prime numbering system involves anticipation both with respect to *mathematical* (possibility) space and with respect to *computational* (Turing machine) space.

With respect to the distinction between *exo-anticipation*, "made by a system about external systems", vs. *endo-anticipation*, "built by a system or embedded in a system about its own behaviour" (Dubois 2008: 30), the prime numbering system seems most adequately classified as a system of endo-anticipation. Here, the system's "upper" algorithm of "saying no", in analogy to Dubois' Libet-inspired interpretation of *free will* (Dubois 2008: 28f) and to Dubois' interpretation of *theorems building* in mathematics (Dubois 2008: 30f), may be interpreted as the 8×8 series disqualifying a natural number as a prime number. If so, the prime numbers manifest as those natural numbers that are *not* overruled by this upper "no". Then, different from the systems of free will and of theorems building, in the case of the prime numbering system the meta-algorithm of this upper "saying no" has been *exposed and deduced in completed detail* by our treatment.

We notice that the basic 8×8 matrix generator of fig. 2 here functions as some kind of *template* for where these "saying no" occur. While the template is *preserved* during the unfoldment of the prime numbering system, the "imprinted" locations from the template as interpreted in the revolving structure of fig. 1 become continuously *rewritten* during the rotations of the original chamber. At the same time the template as such appeared as a certain coding from the peculiar 5:3 structuring of natural numbers represented by fig. 1. Despite the Turing machine computational attribute of the prime numbering system, as demonstrated in the *appendix*, and the according performance as *artificial anticipator* in the sense of Dubois (2010: 20f), this may also indicate some interesting similarities between the prime numbering system and *natural anticipators* (cf. Dubois 2010: 18f) as DNA.

The prime numbering system seems also somewhat ambiguous with respect to the distinction, established by Dubois (2000), between *strong anticipation* and *weak anticipation*. In one sense, the anticipation may be said to be *weak* insofar as the template of fig. 2 represents a model forecasting later events (imprinted locations of composite numbers); in another sense the anticipation may be said to be *strong* insofar as these events are built by and embedded in the 8×8 sets of series (as illustrated by the series of fig. 4).

It may be fruitful to work out these relatings in more concise and qualified detail, including with respect to the mathematical reformulations of the prime numbering system as i) group representation, and as ii) lifted to genonumber representation, both representations achieved in Strand (2011) and first presented by Strand (2010). The same might also be the case for the ontologically deeper (but not yet successfully deduced) maximum pattern coined *Fibonacci neighbour generation of primes*, surfacing from the Fibonacci numbering system for re-establishment of number theory and related geometry (Johansen 2011).

6 Conclusions

The presented generation of an exact as well as complete pattern of prime numbers vs. composite numbers, has been argued to represent a pattern in the maximal sense. Further, this pattern has been proven to be computational, represented by software uniquely generating prime numbers in their correct succession. Also, it has been argued that this computational prime numbering pattern, besides acting as artificial anticipator also may connect to natural anticipators, when being interpreted as a general meta-algorithm to implement the "saying no" algorithm suggested from Libet's experiments and related to Dubois' informational theory of free will.

References

Bateson, Gregory (1972): *Steps to an Ecology of Mind.* New York/Toronto: Ballantine Books.

Dubois, Daniel M. (2000): Review of Incursive, Hyperincursive and Anticipatory Systems - Foundation of Anticipation in Electromagnetism. D.M. Dubois (ed.): *Computing Anticipatory Systems: CASYS'99.* American Institute of Physics, AIP CP 517, 3-30.

Dubois, Daniel M. (2008): New Trends in Computing Anticipatory Systems: Emergence of Artificial Conscious Intelligence with Machine Learning Natural Language. D.M. Dubois (ed.): *Computing Anticipatory Systems: CASYS'07 – Eighth International Conference*, American Institute of Physics, AIP CP 1051, 25-32.

Dubois, Daniel M. (2010): Introduction to the Natural Anticipator and the Artificial Anticipator. D.M. Dubois (ed.): *Computing Anticipatory Systems: CASYS'09 – Ninth International Conference*, American Institute of Physics, AIP CP 1303, 17-24.

Ignatyev , Mikhail B. (2006): The Study of the Adaptational Phenomenon in Complex Systems. D.M. Dubois (ed.): *Computing Anticipatory Systems: CASYS'05 - Seventh International Conference*, American Institute of Physics, AIP CP 839, 322-330.

Johansen, Stein E. (2006): Initiation of 'Hadronic Philosophy', the Philosophy Underlying Hadronic Mechanics and Chemistry. *Hadronic Journal* **29**, 111-135.

Johansen, Stein E. (2010a): Complete Exposition of Non-primes Generated by a Revolving Approach from 8×8 Sets of Series and thereby *ad negativo* Exposition of a Systematic Pattern for the Totality of Prime Numbers. *Journal of Dynamical Systems and Geometric Theories* **8**(2), Taru Publications, 101-171.
Johansen, Stein E. (2010b): Entering Hi-Time Cybernetics – From recent liftings of science, philosophy, meaning theory and robotics onto the human condition. J.S. Vassiliev, A.A. Voronov, M.B. Ignatyev, V.N. Kozlov and R.M. Jusupov (eds.): *Time and Cybernetics – The Centenary of Academician A. A. Voronov*: 286-318. St. Petersburg: St. Petersburg State Polytechnic University.
Johansen, Stein E. (2011): Fibonacci Generation of Natural Numbers and Prime Numbers. C. Corda (ed.): *Proceedings of Third International Conference on Lie-Admissible Treatments of Irreversible Processes*. Kathmandu University, Nepal, Jan. 3-7, 2011, 305-410. Kathmandu University: Sankata Printing Press.
Johansen, Stein E. (2012): Unveiling of Geometric Generation of Composite Numbers Exactly and Completely. *Applied Mathematics & Information Sciences* **6**(2): 223-231.
Rowlands, Peter (2007): *Zero to Infinity. The Foundations of Physics*. Singapore: World Scientific.
Strand, Jon M. (2010): Group Representation and Santilli Genonumber Representation of Johansen Revolving Prime Number Code. Lecture at *Third International Conference on Lie-Admissible Treatments of Irreversible Processes*. Kathmandu University, Nepal, Jan. 3-7, 2011.
Strand, Jon M. (2011): Group Representation of Johansen Revolving Method to Generate the Prime Numbers with Implications to Genonumbers. C. Corda (ed.): *Proceedings of Third International Conference on Lie-Admissible Treatments of Irreversible Processes*. Kathmandu University, Nepal, Jan. 3-7, 2011, 667-670. Kathmandu University: Sankata Printing Press.
Tate, John Terrence (2010): Interview in *Dagens Næringsliv*, Norway, May 25. http://www.dn.no/borspause/article1904996.ece

Appendix

The following program, written in Matlab, was developed as confirming illustration of the correctness of the deduction of the 8×8 series generating non-primes vs. primes exactly and completely. The program expresses the formulas of the 8×8 series and lists from there the prime numbers in succession. In all tests against data bases of prime numbers the numbers generated by the program showed identical to the prime numbers listed in the data bases. The first of these control checks was performed Oct 22, 2010, covering the first 10 million natural numbers. Later control checks performed from rewrites of the program in JSP and Python showed the same identity, the program generating all prime numbers and only them up to the chosen upper limits. We denote this initial software expression of *Johansen Revolving Prime Number Code* as *Johansen Revolver - Strand Algorithm*, abbreviated to *JR-SA*.

```
function[p] = prime(N)
if rem(N,2)==0
    N=N-1;
end
if rem(N,3)==0
    N=N-2;
end
if rem(N,5)==0
   N=N-2;
end

rotmaks=round((N-34)/30);
if N<20
    rotmaks=0;
end
starttall=N-rotmaks*30;

grunntall=[11 13 17 19 23 29 31 37];
P=[0:1:rotmaks;0:1:rotmaks;0:1:rotmaks;0:1:rotmaks;0:1:rotmaks;0:1:rot
maks;0:1:rotmaks;0:1:rotmaks];

for I=1:8
    if starttall<grunntall(I)
        P(I,rotmaks+1)=-1;
    end
end

base=[2 2 2 20 4 10 2 2; 12 6 4 4 2 2 6 18; 2 2 2 4 4 4 26 2; 2 6 12 4
18 4 6 2; 2 2 4 2 2 4 2 2; 8 2 2 4 2 2 4 2; 0 8 18 20 6 2 2 12; 6 2 6
2 6 8 6 4];
initial=[1 4 6 0 -1 2 3 9; 0 1 5 -1 1 4 2 1; 1 3 9 5 2 -1 0 6; 1 1 1 -
1 0 2 3 10; 0 3 3 9 1 2 10 -2; 0 1 3 3 -2 4 5 9; 0 1 1 1 1 -2 1 1; 0 1
2 10 1 1 3 -1];
adding=[2 5 7 1 4 1 13 10; 1 2 3 3 9 9 3 1; 8 7 7 4 1 1 1 13; 0 0 0 0
1 3 2 9; 1 1 2 4 14 7 11 11; 1 5 10 5 5 11 7 1; 0 0 0 0 1 3 12 2; 1 3
1 3 4 3 4 6];
first=[7 18 28 11 5 42 24 47; 8 16 44 4 13 23 31 45; 12 17 41 48 14 2
13 37; 5 9 17 1 10 19 39 50; 4 10 23 35 17 29 54 6; 6 9 20 32 3 25 60
29; 3 11 27 31 12 2 15 35; 5 7 21 37 22 26 50 6];
for I=1:8
    for J=1:8
        w=0;
        var=0;
        r=0;
        while(w==0)
            r=first(I,J)+11*var+base(I,J)*initial(I,J)*var;
            n=var-1;
            if(r>rotmaks)
                w=1;
                n=-1;
            else
                P(I,r+1)=-1;
            end
            while(n>0);
```

```
                r=r+30*n+base(I,J)*adding(I,J);
                if(r>rotmaks)
                    n=-1;
                else
                    P(I,r+1)=-1;
                    n=n-2;
                end
            end
            var=var+1;
        end
        J=J+1;
    end
    I=I+1;
end
p(1,1)=2;
p(2,1)=3;
p(3,1)=5;
p(4,1)=7;
j=5;
for I=1:rotmaks+1
    for J=1:8
        if P(J,I)==-1
        else
            p(j,1)=grunntall(J)+30*P(J,I);
            j=j+1;
        end
        J=J+1;
    end
    I=I+1;
end
```