Table 2. *All 192 structurally different latin squares of order 5 decomposed in its patterns*

from: www.latinsquares5x5.wordpress.com : How many structurally different latin squares order 5 do exist?

Number LS..	composition	Gr	cf	∑	Kv		torus
101	8 8 10 10	1	2		2		101
102	8 13 16 23	4	8		8		304
103	8 14 18 18	4	4		4		304
104	8 16 18 22	5	8		8		304
105	9 10 18 18	4	4		4		301
106	9 13 18 18	4	4		4		106
107	9 22 23 23	2	8		8		119
108	10 15 20 23	4	8		8		301
109	10 18 19 20	5	8		8		301
110	13 13 15 15	1	2		2		110
111	13 16 18 19	5	8		8		106
112	14 15 18 18	4	4		4		112
113	14 19 23 23	2	8		8		119
114	15 18 20 22	5	8		8		112
115	16 16 18 18	1	4		12		110
116	16 16 18 23	4	8		24		106
117	18 18 20 20	1	4		12		110
118	18 20 20 23	4	8		24		112
119, + 318	19 19 22 22	3	4	112	2	158	119
201	8 8 11 14	4	4		2		301
202	8 11 12 13	1	4		4		110
203	8 11 16 21	5	8		8		112
204	8 14 16 16	4	4		4		112
205	9 10 10 12	4	4		2		304

206	9 10 20 20	4	4		4		106
207	9 12 13 13	4	4		2		208
208	9 13 16 16	4	4		4		208
209	9 14 17 23	2	8		8		609
210	9 14 21 23	2	8		8		617
211	10 11 12 15	1	4		4		110
212	10 12 20 21	5	8		8		106
213	11 12 16 23	4	8		8		208
214	11 12 20 23	4	8		8		309
215	11 14 15 15	4	4		2		309
216	11 15 17 20	5	8		8		414
217	12 13 16 17	5	8		8		416
218	14 15 20 20	4	4		4		309
219	16 16 20 20	1	4		12		219
220	17 17 21 21	3	4	112	12	120	220
301	8 8 13 13	3	2		2		301
302	8 11 18 18	2	4		4		106
303	8 21 22 23	5	8		8		119
304	10 10 15 15	3	2		2		304
305	10 12 18 18	2	4		4		112
306	10 19 21 23	5	8		8		119
307	11 15 18 18	2	4		4		208
308	11 19 23 23	4	8		8		617
309	12 13 18 18	2	4		4		309
310	12 22 23 23	4	8		8		617
311	13 17 19 23	5	8		8		609
312	15 17 22 23	5	8		8		609
313	17 17 18 23	4	8		24		220
314	17 18 19 22	4	8		8		609

315	17 21 23 23	1	8		24		417
316	18 19 21 22	4	8		8		617
317	18 21 21 23	4	8		24		617
318, +119	19 19 22 22	1	4	112	2	158	318
401	9 12 22 22	4	8		4		609
402	9 14 17 18	4	8		8		220
403	9 14 18 21	4	8		8		609
404	9 14 19 22	1	8		4		417
405	9 16 21 22	5	8		8		609
406	9 17 20 22	5	8		8		220
407	11 12 16 18	2	8		8		416
408	11 12 18 20	2	8		8		414
409	11 14 19 19	4	8		4		609
410	11 17 19 21	4	8		8		220
411	12 17 21 22	4	8		8		220
412	14 16 17 19	5	8		8		220
413	14 19 20 21	5	8		8		609
414	16 16 16 16	3	2		6		414
415	17 17 17 17	1	2		6		415
416	20 20 20 20	3	2		6		416
417	21 21 21 21	1	2	112	6	116	417
501	8 10 16 16	2	4		4		301
502	8 13 20 20	3	4		4		106
503 , + 605	8 14 19 22	5	8		4		119
504 , + 608	9 10 19 22	4	8		4		119
505	9 10 21 23	4	8		8		119
506, + 610	9 13 19 22	5	8		4		617
507	9 16 22 23	4	8		8		617

508	9 17 22 23	1	8		8		417
509	9 18 21 22	5	8		8		617
510	10 10 12 15	2	4		2		304
511	10 11 15 15	2	4		2		106
512	10 15 16 20	2	8		8		112
513	10 19 21 21	4	8		8		119
514, + 615	11 12 18 18	3	4		4		208
515	11 19 21 23	5	8		8		617
516	12 17 22 23	5	8		8		609
517	13 15 16 16	2	4		4		208
518	14 15 17 23	4	8		8		609
519, + 620	14 15 19 22	4	8		4		617
520	14 16 19 23	4	8		8		617
521	14 17 18 19	5	8		8		609
522	14 19 21 23	1	8		8		318
523	15 17 17 22	4	8		8		220
524	16 16 16 18	2	8		24		309
525	16 17 19 22	4	8		8		609
526	16 17 21 23	4	8		24		609
527	16 17 21 23	4	8		24		609
528	16 19 21 22	4	8		8		617
529	17 17 20 23	5	8		24		220
530, + 627, 751-753	17 19 21 22	1	8		8		417
531	20 21 21 23	5	8	224	24	284	617
601	8 8 11 13	2	4		2		301
602	8 10 20 20	2	4		4		304
603	8 12 13 13	2	4		2		112
604	8 13 16 20	2	8		8		106
605, + 503	8 14 19 22	4	8		4		119

608, + 504	9 10 19 22	5	8		4		119
609	9 13 17 23	4	8		8		609
610, +506	9 13 19 22	4	8		4		617
611	9 17 18 22	5	8		8		609
612	9 20 22 23	4	8		8		617
613	9 21 22 23	1	8		8		318
614	10 15 16 16	3	4		4		112
615, + 514	11 12 18 18	3	4		4		309
616	11 17 19 23	5	8		8		609
617	12 21 22 23	5	8		8		617
618	13 15 20 20	2	4		4		309
619	13 17 17 19	4	8		8		220
620, + 519	14 15 19 22	5	8		4		617
621	14 17 19 23	1	8		8		417
622	14 18 19 21	5	8		8		617
623	14 19 20 23	4	8		8		617
624	16 17 17 23	5	8		24		220
625	16 21 21 23	5	8		24		617
626	17 19 20 22	4	8		8		609
627, + 530, 751-753	17 19 21 22	1	8		8		417
628	17 20 21 23	4	8		24		609
629	17 20 21 23	4	8		24		609
630	18 20 20 20	2	8		24		208
631	19 20 21 22	4	8	224	8	284	617
701	8 10 11 19	5	8		4		304
702	8 10 12 22	5	8		4		301
703	8 10 16 21	4	8		8		301
704	8 10 20 21	4	8		8		304
705	8 11 13 19	4	8		4		112

706	8 11 16 23	5	8		8		112
707	8 11 18 20	1	8		8		110
708	8 11 18 21	4	8		8		106
709	8 12 13 22	4	8		4		112
710	8 13 16 16	1	8		8		110
711	8 14 16 18	5	8		8		106
712	8 16 20 22	4	8		8		106
713	9 10 18 20	5	8		8		112
714	9 13 16 18	5	8		8		309
715	9 14 23 23	3	8		8		617
716	9 19 22 22	2	8		4		617
717	10 11 15 19	4	8		4		106
718	10 12 15 22	4	8		4		106
719	10 12 16 18	1	8		8		110
720	10 12 18 21	4	8		8		112
721	10 12 20 23	5	8		8		106
722	10 15 20 20	1	8		8		110
723	10 16 19 20	4	8		8		112
724	11 13 15 19	5	8		4		208
725	11 15 16 18	1	8		8		219
726	11 15 17 18	4	8		8		416
727	11 15 20 23	5	8		8		309
728	11 16 18 19	4	8		8		208
729	11 18 19 20	4	8		8		309
730	12 13 15 22	5	8		4		309
731	12 13 16 23	5	8		8		208
732	12 13 17 18	4	8		8		414
733	12 13 18 20	1	8		8		219
734	12 16 18 22	4	8		8		208
735	12 18 20 22	4	8		8		309

736	13 15 16 17	4	8		8		416
737	13 15 17 20	4	8		8		414
738	13 16 19 20	4	8		8		309
739	14 15 18 20	5	8		8		208
740	14 19 19 22	2	8		4		617
741	15 16 20 22	4	8		8		208
742	16 16 17 18	4	8		24		414
743	16 16 18 21	4	8		24		309
744	16 17 18 20	5	8		24		414
745	16 17 18 20	5	8		24		416
746	16 18 20 21	5	8		24		309
747	16 18 20 21	5	8		24		208
748	17 17 19 22	2	8		8		220
749	17 17 21 23	2	8		24		220
750	17 18 20 20	4	8		24		416
751, + 530, 627	17 19 21 22	3	8		8		609
752, + 530, 627	17 19 21 22	2	8		8		609
753, + 530, 627	17 19 21 22	2	8		8		609
754	17 21 21 23	2	8		24		609
755	18 20 20 21	4	8		24		208
756	19 21 21 22	2	8	448	8	568	616
Number LS..	composition	Gr	cf	∑	Kv	∑	torus

Table 2. *All 192 structurally different latin squares of order 5 decomposed in its patterns*

The table must be used together with table 1 (www.latinsquares5x5.files.wordpress.com/2015/07/23solatinopatterns.pdf) in which the 23 patterns are described. To construct LS756 (LS = Latin Square) with the Solatino cards you take the black pattern 7 together with the patterns 19, 21, 21, and 22 in correct colours, and assemble them – in a puzzle way - to a latin square. (Note: first choose colours for pattern 19 and 22, then take fitting colours for the 21-patterns). With the Solatino cards the assembling is quite easy, without Solatino it is more a challenge! The determination of an arbitrarily made latin square goes the opposite way: decompose the square in its 5 patterns, and find the matching classification LS number.

Cf stands for control factor (the 12345-mode contribution, see explanation paragraph 4.1) and is very important for this paper. The column Gr shows in which of the 5 groups of permutations in table 3 (www.latinsquares5x5.files.wordpress.com/2015/07/perm30x12.pdf) a square appears. Kv gives the (Solatino-bound) colour variation of a square, for the scope of this paper of minor importance.

The torus-column is very interesting for (among others) Yp de Haan and his website www.latinsquares.nl. In that website Yp describes 18 different order 5 toruses. A torus is generated from a square when its rows and columns are repeated endlessly horizontally and vertically.
If you create a torus by means of expanding square LS415 you will find out that this very special torus does not generate new squares; wherever you place your 5 x 5 square in the torus, it will always be an LS415. LS101 does the same. The torus generated with LS219 produces only two new squares: LS 725 and 733. The maximum of structurally different squares a torus can produce is theoretically 25.
The numbers in the torus-column point to the torus in which a certain square will be found. For example: LS755 will be found in the torus that is generated with LS208, as does also LS747. Another example: the torus that is created with LS609 produces 24 other structurally different latin squares, among which LS751, 752, 753 and 754, see the table. In the torus-column the number 609 appears 25 times, as does also 617.
Despite our different conception of the term *structurally different pattern* the torus-column shows the perfect harmony between Yp's results and mine: Yp's 18 toruses (Fig. 3.2.1 of is website, but the shown squares expanded to a torus) generate exactly my 192 structurally different squares, and vice-versa.

In his website Yp de Haan distinguishes only 4 structurally different patterns: ST(ring), L(attice), TC (triple-couple), and CCS (couple-couple-single). These 4 correspond with my patterns 1, 4, 6, and 13 respectively. Considered on torus-level, this approach may work indeed: Every order 5 torus has been built up with one or more of these 4 patterns. But the approach fails completely on latin-square 5x5 level. Not any order 5 latin square can be described with only these 4 patterns.

The table shows that there are 5 compositions in which the cards can be assembled in two or three structurally different ways: (LS)526/527, 628/629, 744/745, 746/747, and 751/752/752. To distinguish these compositions the permutation rows of table 3 (see entrance above) are needed.

The 24 numbers in red form a group of squares with the associative properties of an Abelian group (of no importance for te scope of this paper).