

Investigation of line-shaped and square-shaped discrete point structures: Grouping under different algorithms

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Summary

The groupings in discrete square structures and line structures are examined. The number of emerging groups is shown for both the sociality and polarity algorithm. There are two theorems for the number of groups with the polarity algorithms for line structures and square structures that I discovered.

Theorem 1:

Under the polarity algorithm, square structures of side length m , where m is straight, always form two groups of the same size $m^2/2$.

Theorem 2:

Under the polarity algorithm, for line structures, all even groups combine into a single group, all odd groups split into a single element and the rest of the group.

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CHAPTER ONE

Introduction

In this work, I examine two algorithms that I call sociality and polarity. I define sociality in such a way that every particle approaches the particle that is the only one closest to it. I define polarity in such a way that each particle approaches the particle that is the only one furthest away from it.

I analyze discrete structures, namely square lattice-shaped point structures and line-shaped point structures. I calculate how these structures group under the above algorithms. In doing so, I discover two theorems for the grouping of linear point structures under the polarity algorithm.

Definition polarity algorithm

The element merges with the element that is clearly identifiable as the element with the greatest distance.

Definition sociality algorithm

The element merges with the element that is clearly identifiable as the element with the smallest distance.

CHAPTER TWO

Square grid structures

2.1 Grouping of square grid structures under the sociality algorithm

The group formation is shown here for square structures with two even side lengths n and m , where $n=m$, for $2 \leq n \leq 10$.

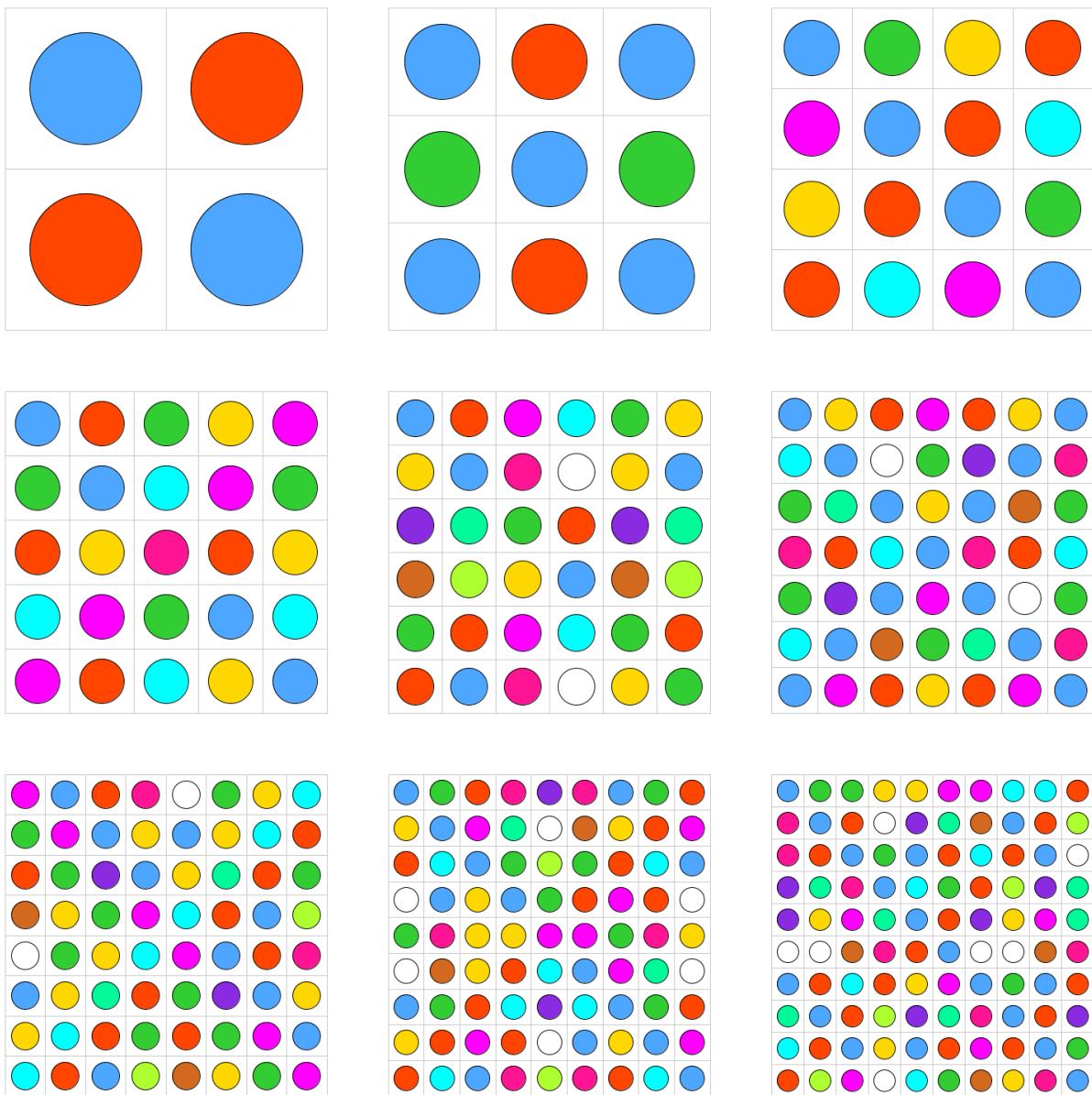


Image 2.1.1: Grouping of square grid structures under the sociality algorithm

N	Points	Emerging Groups	Group Sizes
2	4	2	(2)(2)
3	9	3	(5)(2)(2)
4	16	6	(4)(4)(2)(2)(2)(2)
5	25	7	(4)(4)(4)(4)(4)(4)(1)
6	36	12	(5)(5)(5)(5)(2)(2)(2)(2)(2)(2)(2)(2)
7	49	11	(13)(6)(6)(4)(4)(4)(4)(2)(2)(2)(2)
8	64	12	(10)(10)(10)(10)(6)(6)(2)(2)(2)(2)(2)(2)
9	81	17	(12)(12)(7)(7)(7)(7)(6)(2)(2)(2)(2)(2)(2)(2)(1)
10	100	22	(14)(14)(4)(4)(4)(4)(4)(4)(4)(4)(4)(4)(4)(4)(3)(3)(3)(3)(3)(3)(3)

Table 2.1: Grouping of square grid structures under the sociality algorithm

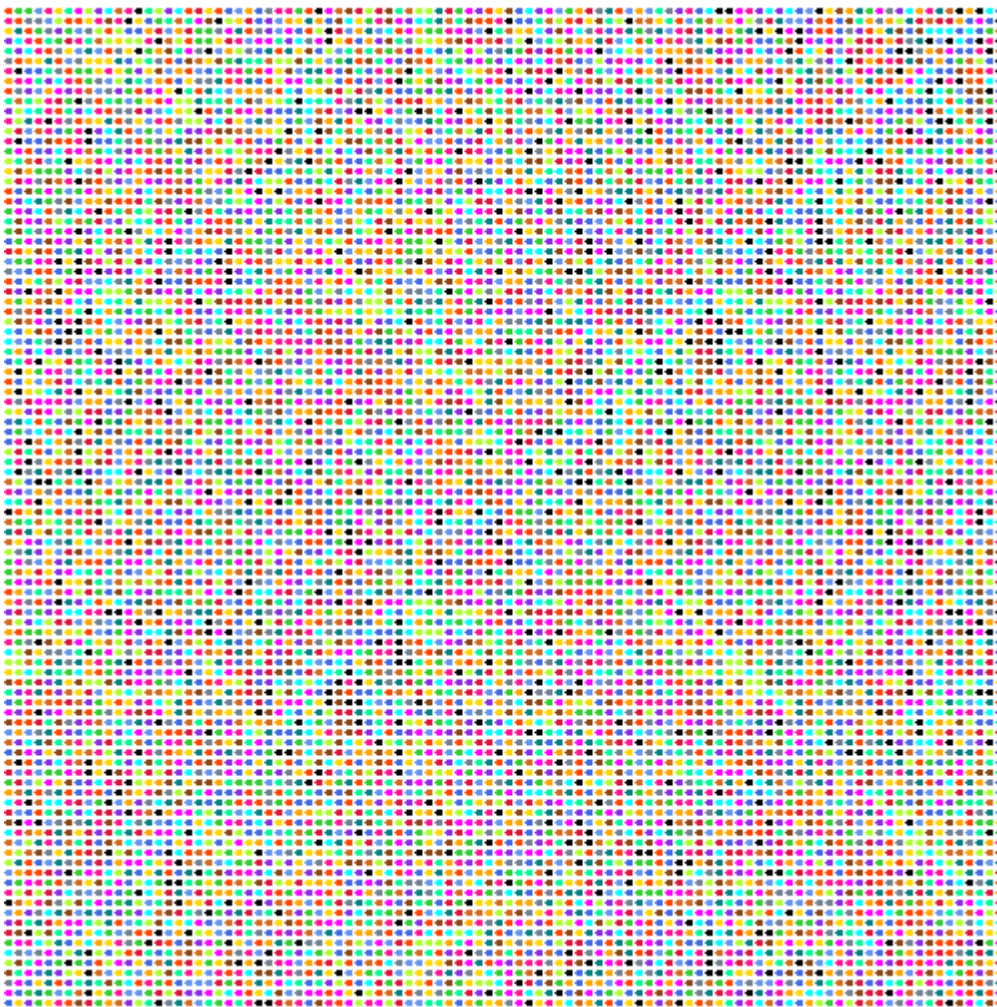


Image 2.1.2: Grouping of square grid structures under the sociality algorithm for 10000 points

2.2 Grouping of square lattice structures under the polarity algorithm

Theorem 1:

Under the polarity algorithm, square structures of side length m , where m is straight, always form two groups of the same size $m^2/2$.



Image 2.2: Grouping of square grid structures under the sociality algorithm.

The group formation under the polarity algorithm for square structures with two even side lengths n and m is summarized as follows, where $n=m$.

All such square structures form two groups of the same size $(n*m)/2$. The sketch with $n=4$, $m=4$ illustrates the arrangement of the groups.

CHAPTER THREE

Line structures

3.1 Grouping of line structures under the sociality algorithm

From 1 to 20, line structures with the following numbers of particles unite to form a single group through the sociality algorithm:

1, 2, 3, 4, 7, 10, 12, 15, 18.

Line structures with the following length combine to form two groups:

5, 6, 8, 9, 11, 16, 19.

Line structures with the following length combine to form three groups:

13, 17.

Line structures with the following length combine to form four groups:

14.

Line structures with the following length combine to form five groups:

20.

In the following, the line structures with 1-20 elements are shown under association based on the sociality algorithm.

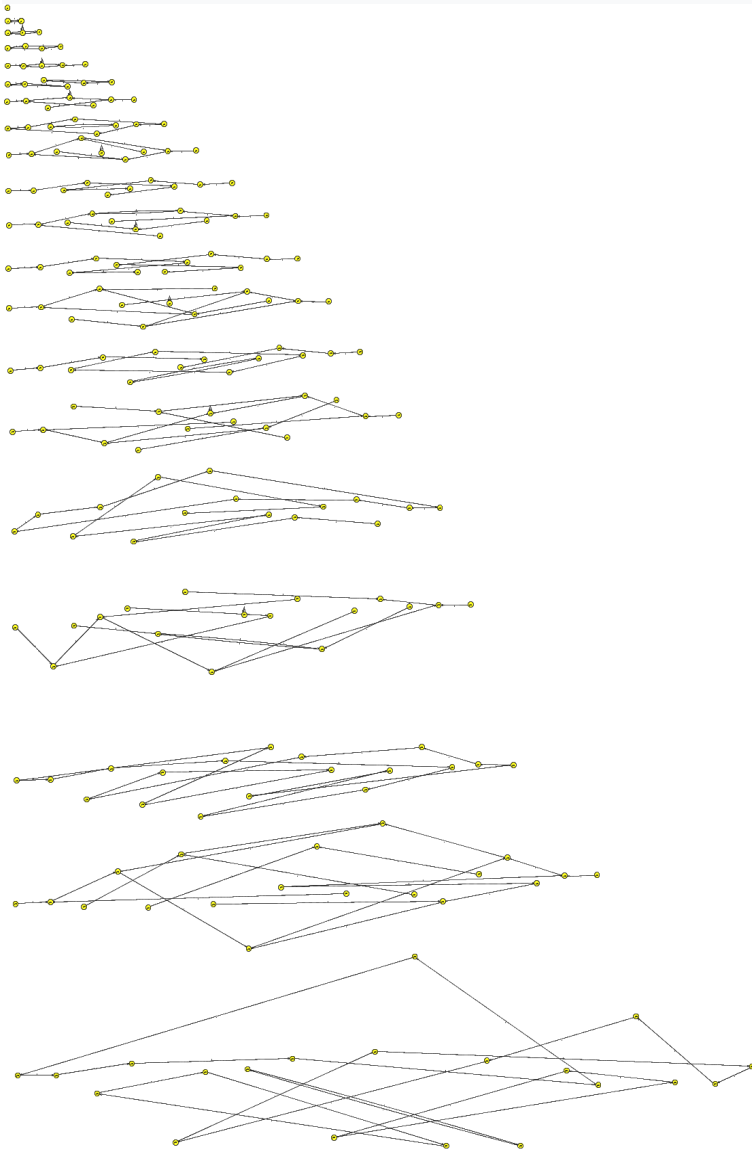


Image 3.1: Line structures from one to twenty based on the sociality algorithm.

The forms that arise in line structures from one to ten under the sociality algorithm are shown in the following picture:

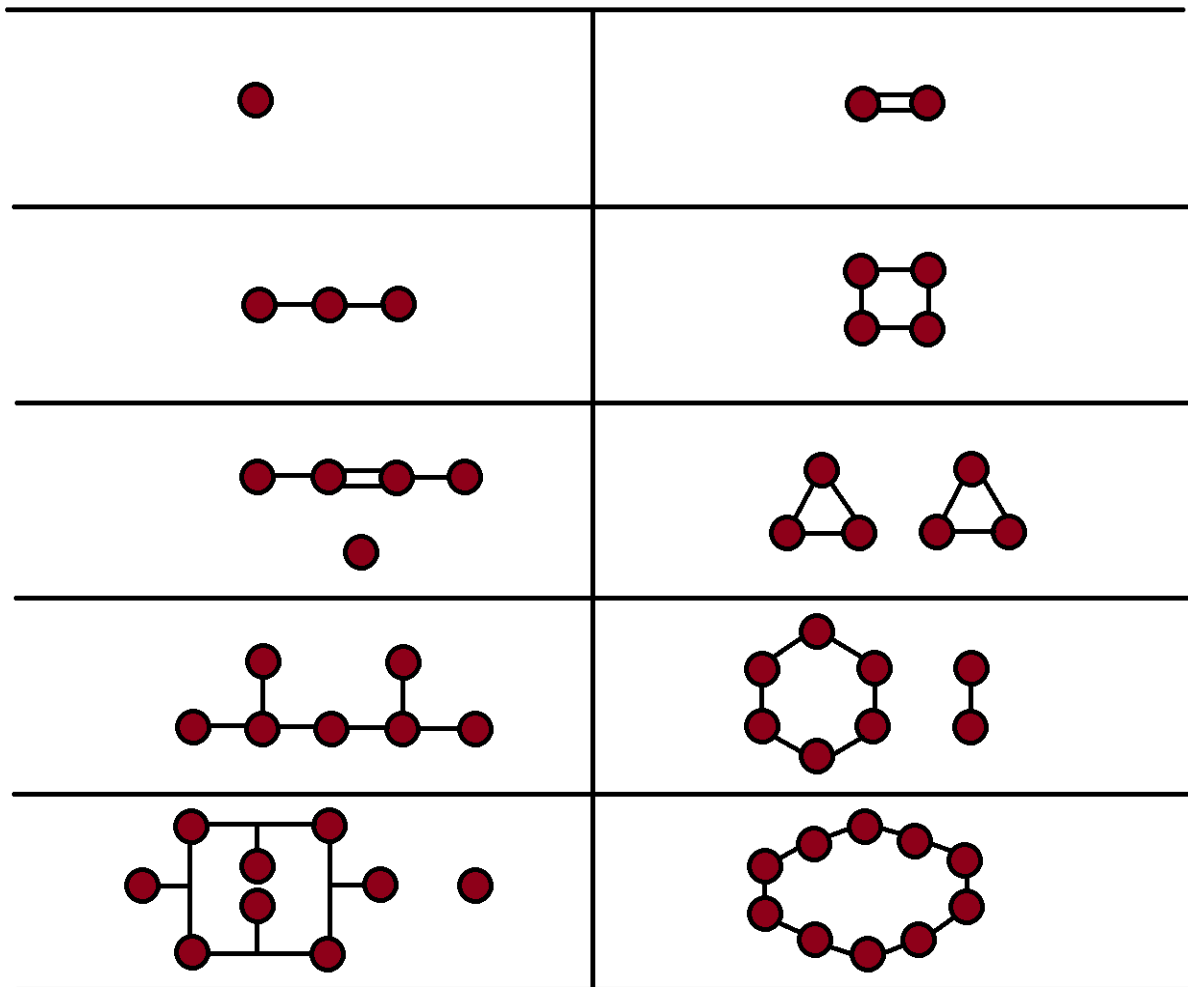


Image 3.2: Forms of line structures from one to ten based on the sociality algorithm

3.2 Grouping of line structures under the polarity algorithm

Theorem 2:

Under the polarity algorithm, all groups of even size combine into a single group, all groups of odd size split into a single element and the rest of the group.

In the following, the line structures with 2-11 elements are shown under connection based on the polarity algorithm.

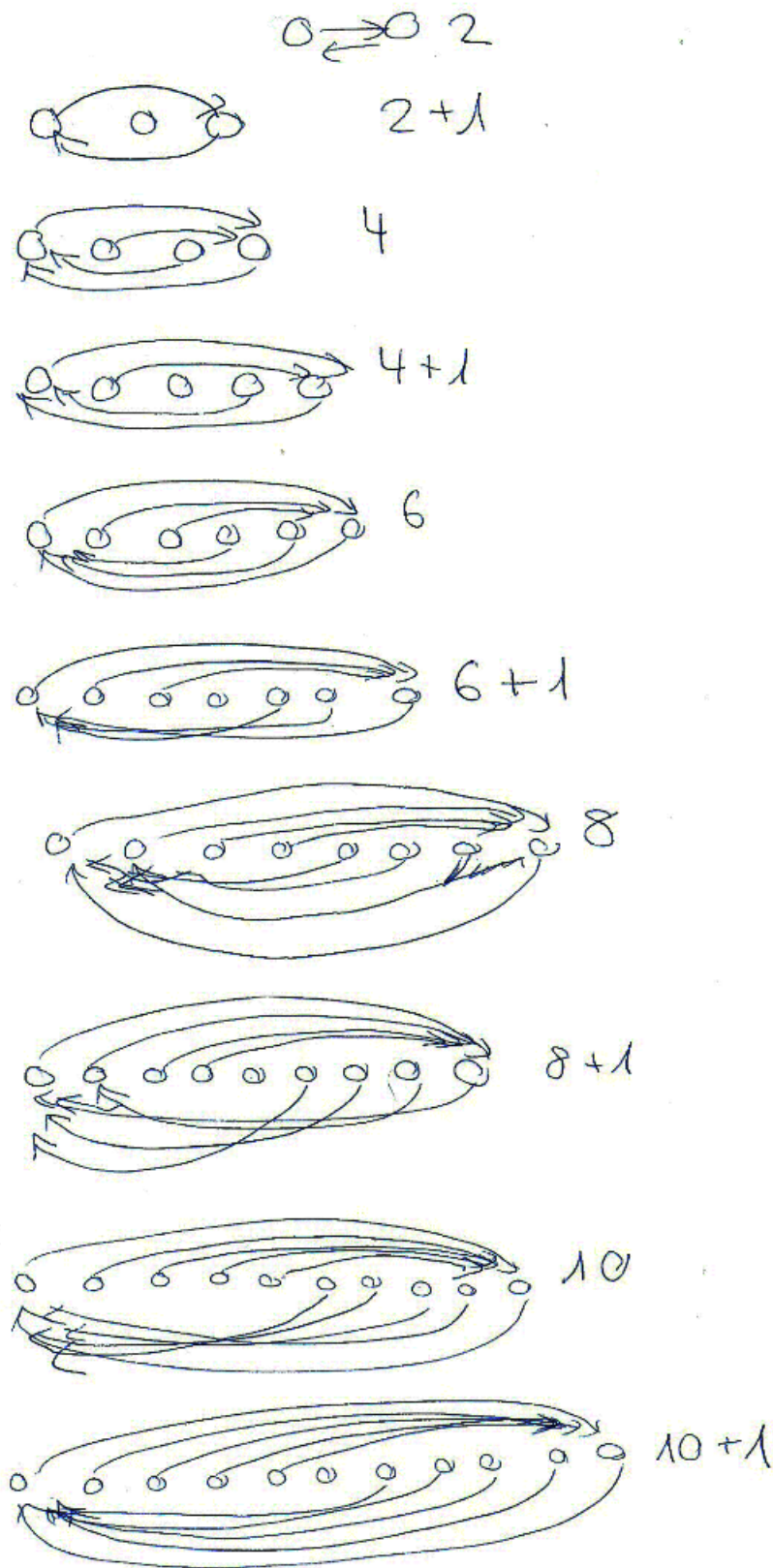


Image 3.3: Line structures from two to eleven based on the polarity algorithm

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