Concept: Flocking Simulation Based on Checkout Co-occurrency

I want to create a dynamic self-organized flocking simulation based on books been checked out at the same time. I assume it would be interesting to see:

1) Book titles with a specific keyword may contain different Dewey classes and different subjects
2) Books checked out with these books may contain a broader range of Dewey classes and subjects
3) These books may aggregate at a different Dewey class than their designated ones

With these assumptions, I queried book titles with the keyword “architecture”, for its multiple meaning in different disciplines. For each book title, I also queried books that were checked in and out at the same time with it, to approximate relevant books that doesn’t have the keyword “architecture”.

A_bib	A_title	A_dewey	A_subject	B_bib	B_title	B_dewey	B_subject
1639244	Why buildings stand up the strength of architecture	624	Structural engineering	1848385	Creating with soapstone simple techniques beautiful projects	736	Soapstone carving Technique;Sopastone carving Technique
1639244	Why buildings stand up the strength of architecture	624	Structural engineering	2051838	Japan global designs for new look interiors	747	Interior decoration Japan
1639244	Why buildings stand up the strength of architecture	624	Structural engineering	2033690	Eastern spirit	747	Architecture East Asia;Interior decoration East Asia
1639244	Why buildings stand up the strength of architecture	624	Structural engineering	2140082	Jack Kirby	741	Cartoonists;Comic books strips etc History and criticism;Kirby Jack Criticism and interpretation
106844	Mechanical and electrical systems in construction and architecture	696	Buildings Electric equipment;Buildings Mechanical equipment	71043	Your engineered house	728	Architecture Domestic;House construction
106844	Mechanical and electrical systems in construction and architecture	696	Buildings Electric equipment;Buildings Mechanical equipment	1305518	good house building a life on the land	690	House construction;Missoula Mont Description and travel
2109990	Rural Studio Samuel Mockbee and an architecture of decency	720	Architecture Study and teaching Alabama Hale County;Auburn Un	1946889	Outsider art spontaneous alternatives	709	Art Modern 20th century;Outsider art
2109990	Rural Studio Samuel Mockbee and an architecture of decency	720	Architecture Study and teaching Alabama Hale County;Auburn Un	2276551	Overcome by happiness	782	Rock music 1991 2000
1969811	What style is it a guide to American architecture	720	Architecture United States Themes motives	2215759	What style is it a guide to American architecture	720	Architecture United States
2215759	What style is it a guide to American architecture	720	Architecture United States	1969811	What style is it a guide to American architecture	720	Architecture United States Themes motives
2154281	Le Corbusier before Le Corbusier applied arts architecture painting ph	720	Le Corbusier 1887 1965 Exhibitions	2142574	Le Corbusier architect of the twentieth century	720	Le Corbusier 1887 1965 Criticism and interpretation

From the queried data, I ran another analysis that records for each subject title appeared in the dataset:

1) Dewey classes of itself
2) Subjects that co-occurred with it within the same book title
3) Frequencies of their co-occurrency
4) Dewey classes of the co-occurred books
5) Subjects of co-occurred books
6) Frequencies of their co-occurrency

subject_id	subject_name	A_dewey	A_subject	A_subject	B_dewey	B_subject	B_subject_frequency
0	Structural engineering	[624, 693, 724, 721, 690]	[654, 655,	[39, 45, 1,	[736, 747,	[2661, 2662, 237, 777, 2663, 2664, 2665, 2666, 3174, 317	[1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 3, 2, 2, 2, 10, 1, 1, 1, 4, 1
1	Buildings Electric equipment	[696]	[2]	[2]	[728, 690]	[1127, 2667, 2668]	[1, 2, 1]
2	Buildings Mechanical equipment	[696]	[1]	[2]	[728, 690]	[1127, 2667, 2668]	[1, 2, 1]
3	Architecture Study and teaching Al	[720, 728]	[4, 5, 6, 7,	[41, 47, 41	[709, 782,	[622, 2669, 36, 2737, 2738, 2739, 2740, 2741, 2742, 2743	[1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 14, 14, 7, 7, 7, 7, 1, 1,
4	Auburn University Department of A	[720, 728]	[3, 5, 6, 7,	[41, 39, 41	[709, 782,	[622, 2669, 36, 2737, 2738, 2739, 2740, 2741, 2742, 2743	[1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 7, 7, 7, 7, 7, 7, 1, 1, 3,
5	Auburn University Dept of Architec	[720, 728]	[3, 4, 6, 7,	[47, 39, 39	[709, 782,	[622, 2669, 36, 2737, 2738, 2739, 2740, 2741, 2742, 2743	[1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 14, 14, 7, 7, 7, 7, 1, 1,
6	Low income housing Alabama Hale	[720, 728]	[3, 4, 5, 7,	[41, 41, 39	[709, 782,	[622, 2669, 36, 2737, 2738, 2739, 2740, 2741, 2742, 2743	[1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 7, 7, 7, 7, 7, 7, 1, 1, 3,
7	Mockbee Samuel	[720, 728]	[3, 4, 5, 6,	[39, 39, 39	[709, 782,	[622, 2669, 36, 2737, 2738, 2739, 2740, 2741, 2742, 2743	[1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 7, 7, 7, 7, 7, 7, 1, 1, 3,
8	Sustainable architecture Alabama H	[720]	[3, 4, 5, 6,	[38, 38, 36	[709, 782,	[622, 2669, 36, 2737, 2738, 2739, 2740, 2741, 2742, 2743	[1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 7, 7, 7, 7, 7, 7, 1, 1, 1,

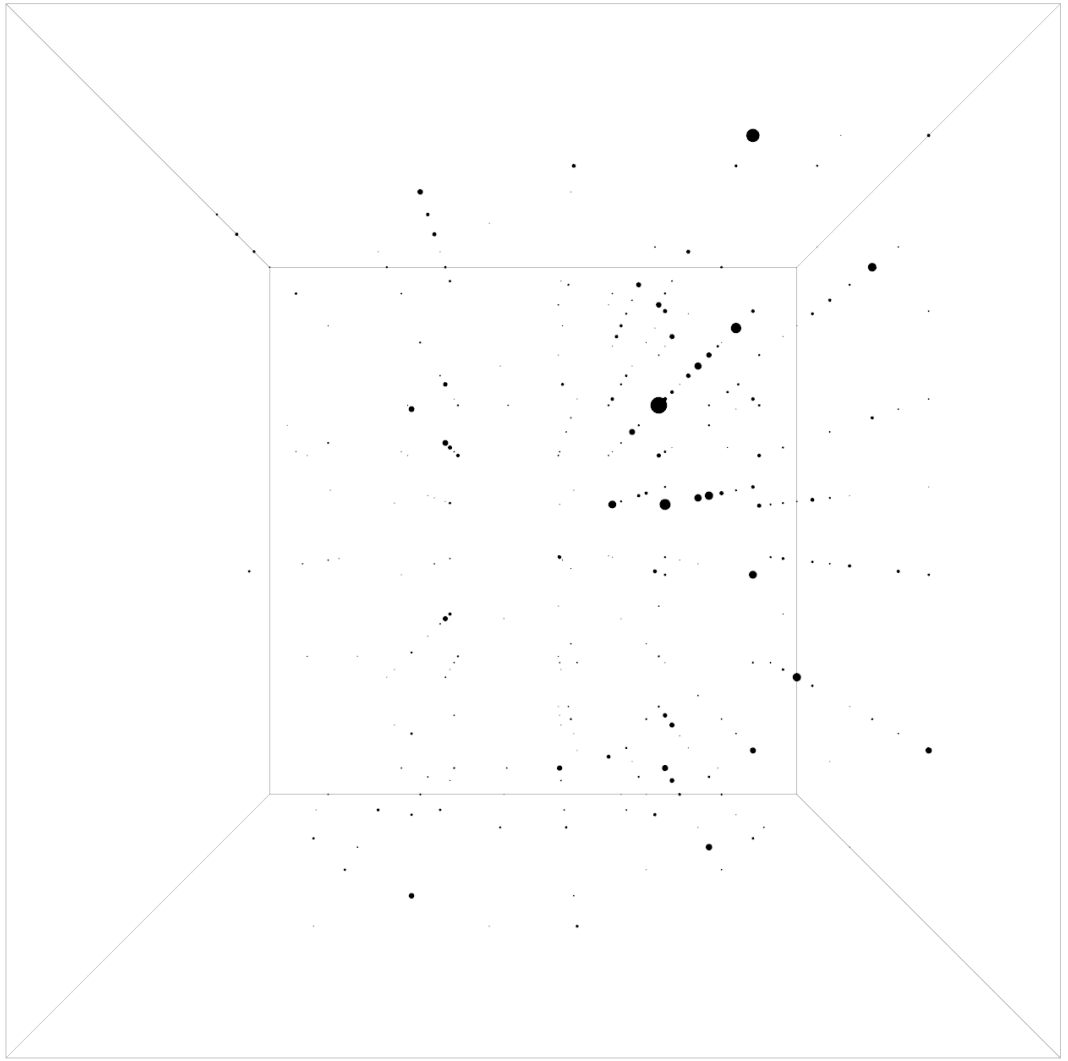
From here, each subject record can be used as a single swarm agent in the flocking simulation. Every time it meets another agent, it will be able to check whether they have co-occurrency relations and how strong they are related, so that the flocking forces can be determined.

The flocking simulation does not intend to deliver a result right at the beginning. Instead, it requires interaction with provided parameters and observation through its self-organized forms. Different parameter setups could lead to different results.

The flocking system contains two components:

I. static points, which represent Dewey classes

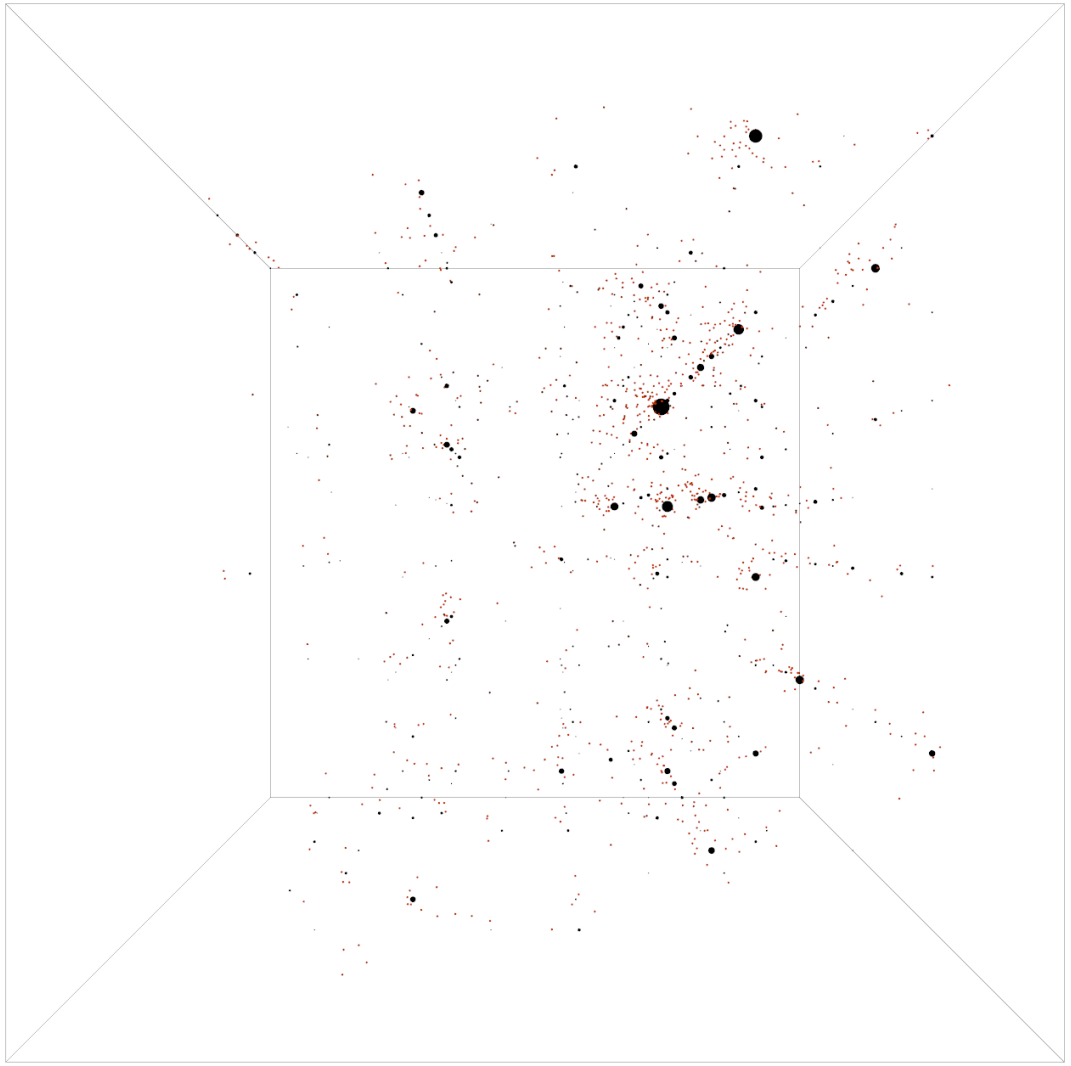
- **Position**
  first three digits of Dewey classes(abc.def)
  a -> point.x, b -> point.y, c -> point.z
- **Scale**
  determined by number of subjects that belongs to the dewey class
- **Attraction force**
  create attraction force for agents that belongs to this dewey class



II. Swarm agents that represent subjects

These points are initiated with random locations and random flaying directions. When meet another agent or a Dewey class point within its search distance, it will check whether they are co-currently or directly related and how strong the connections are, then calculate vector of its next movement based on flocking principles of alignment, cohesion, and separation

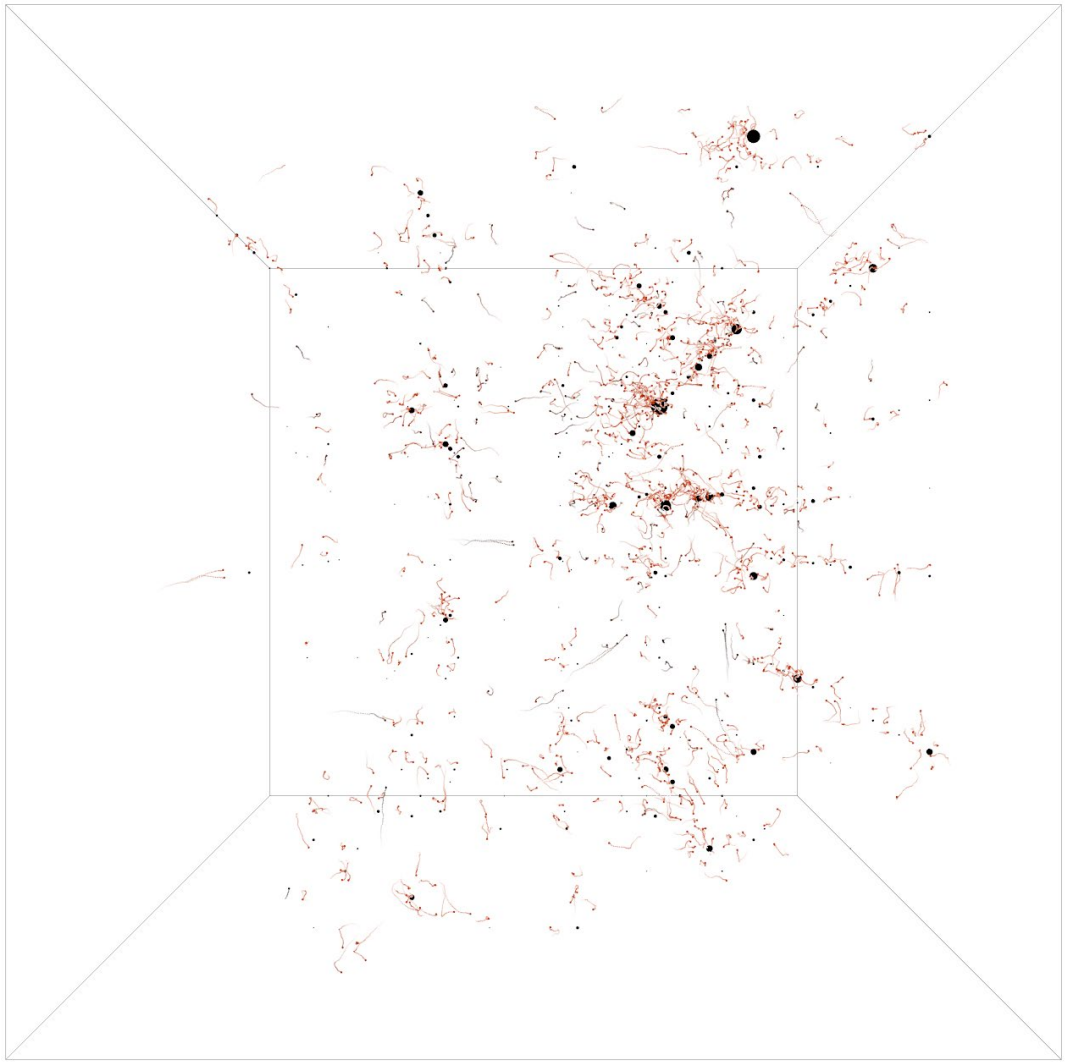
- **Separation force**
  steer away from agents that don't have any relation with itself
- **Alignment force**
  align with the velocity vector of agents that have co-occurrent relation with itself
- **Cohesion force**
  cohere to the flocking center of all related agents nearby
- **Random force**
  random velocity vector to the next movement



II. Swarm agents that represent subjects

The visualization of agents consists of following components:

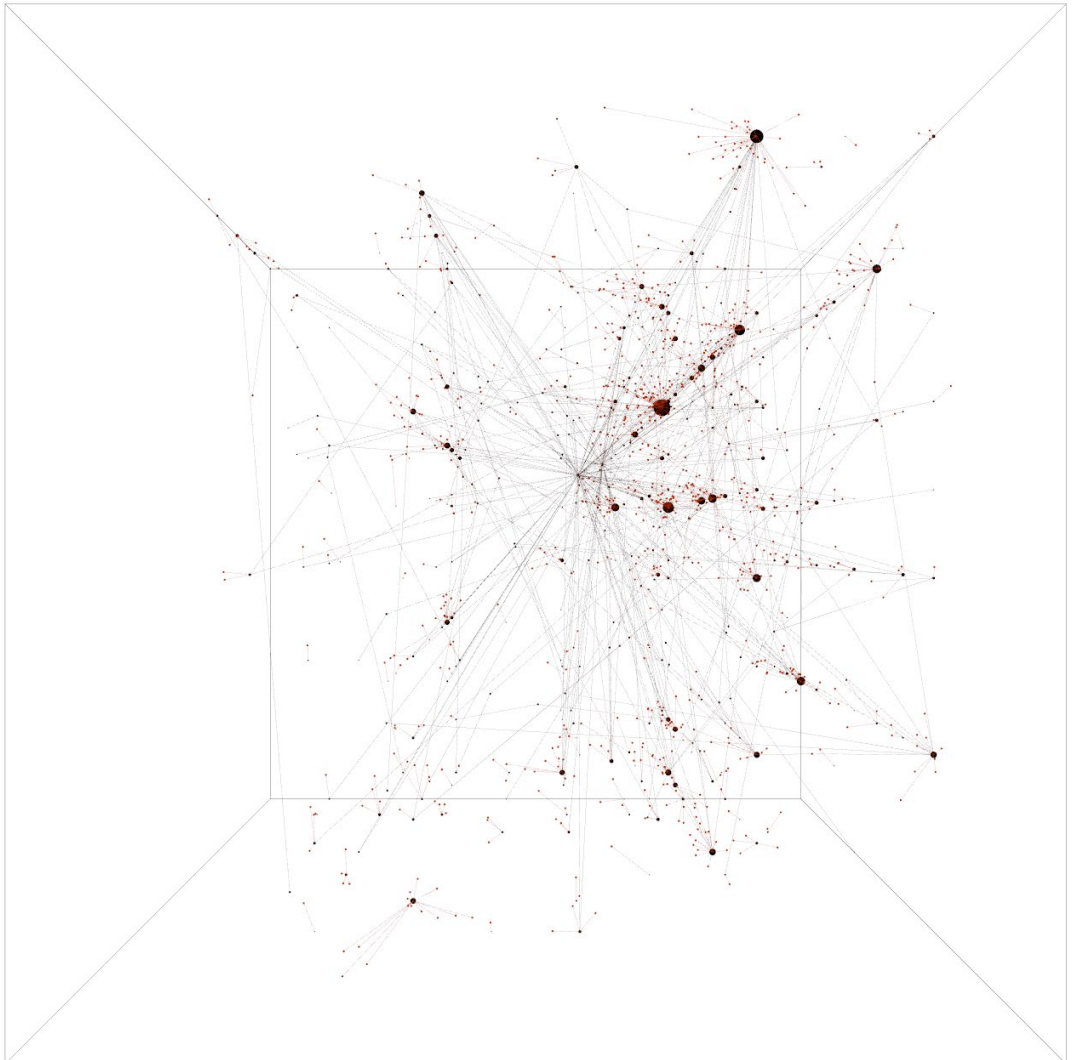
- **Path**
  a path line formed by previous position points, color ranges from black to red, the closer the agent get to dewey class points it belongs, the more red it become, older position points will fade out



II. Swarm agents that represent subjects

The visualization of agents consists of following components:

- **Connection to dewey class**
  connection line from agent to dewey classe points it belongs, color ranges from black to red, the closer the agent get to dewey class points it belongs, the more red it become

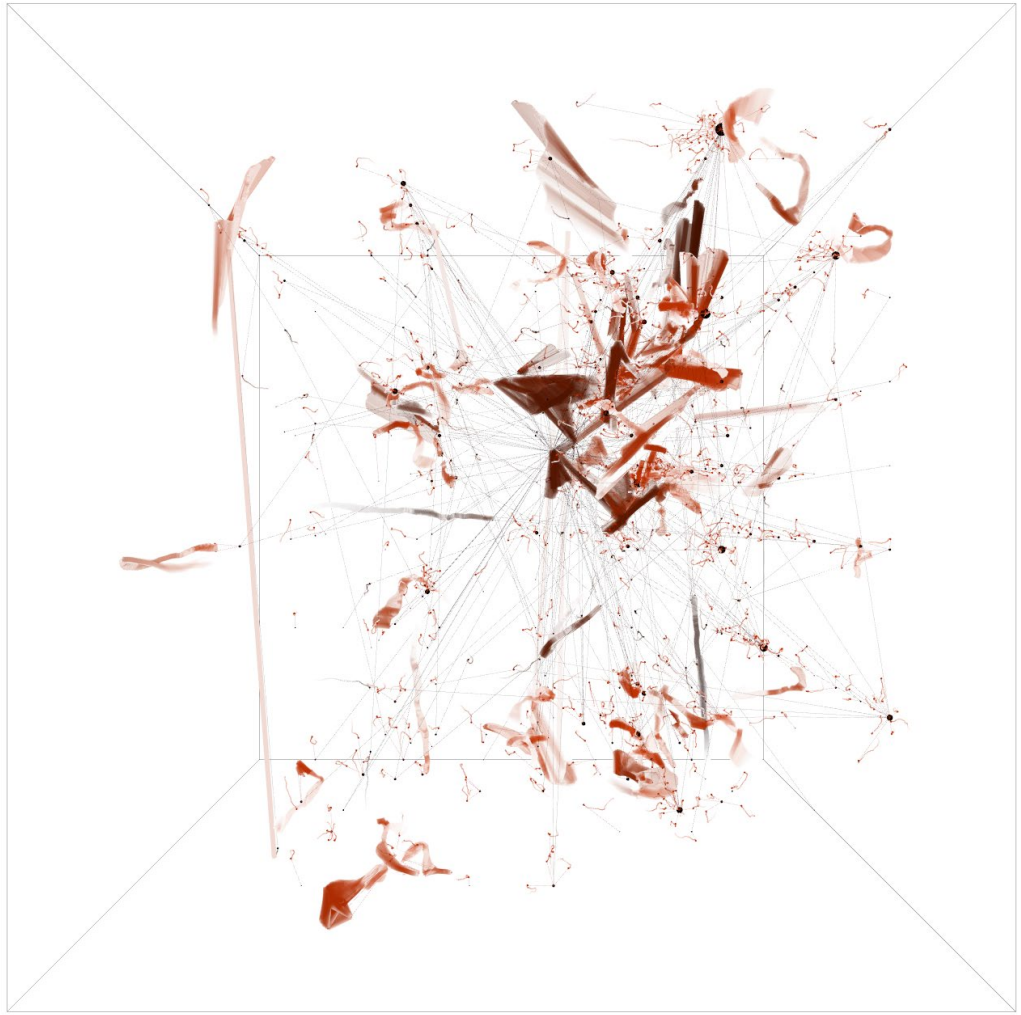


II. Swarm agents that represent subjects

The visualization of agents consists of following components:

- **Connection to co-occurrent related agents**
  connection line from the agent to surrounding agents that are co-occurrent related, color averaged from the color of connection points on both ends

start



end