

# Business Analytics and Data Driven Decision Making

## Session#06: Lecture#12: Visual Analytics: Geospatial Analysis: Roskilde Festival



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# Outline

- **Business Case: Roskilde Festival (2015-18)**
  - Phenomena
  - About the Roskilde Festival
  - Research Project Objectives
  - Cloud Computing Architecture & Big Data Analytics Governance
  - Results
    - Big Social Data Analytics
    - Geospatial Analytics

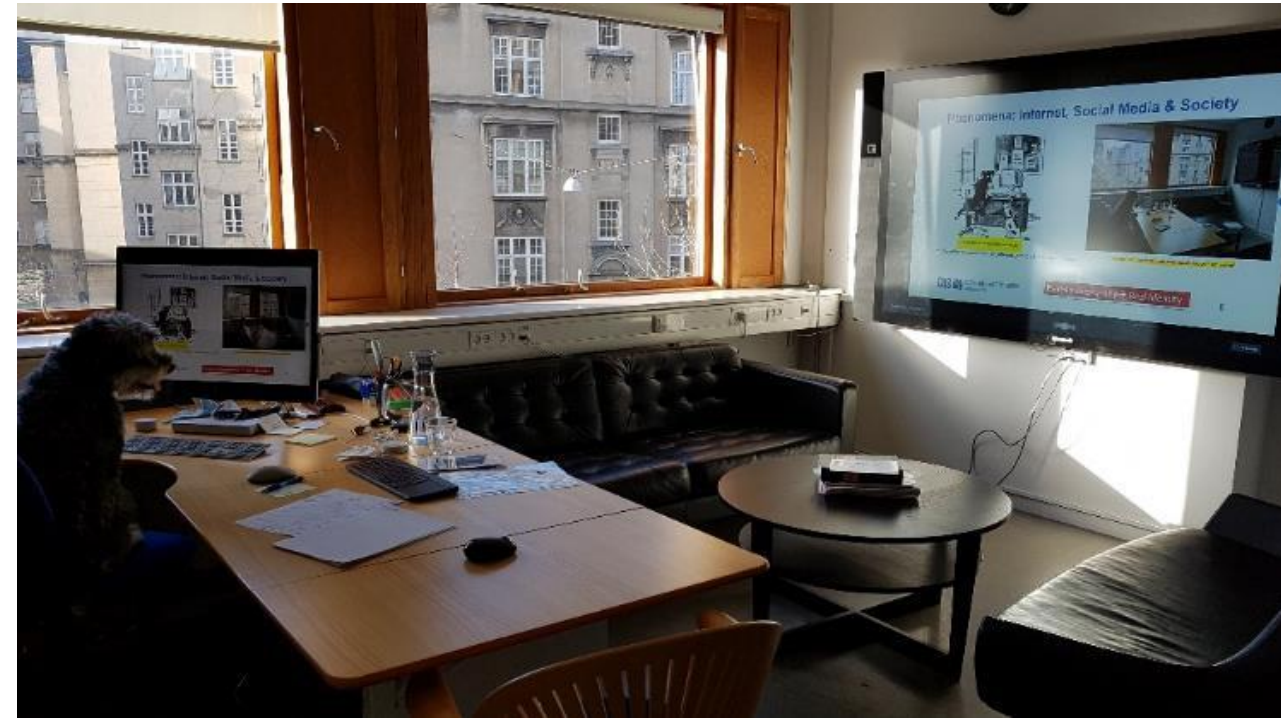
**Phenomena:** Internet, Social Media, and Society  
**Conceptual Model:** Big Social Data

# Phenomena #1: Internet, Social Media and Society: **Digital Identity**

(Vatrapu, Robertson, & Dissanayake, 2008)  
(Vatrapu, 2013)



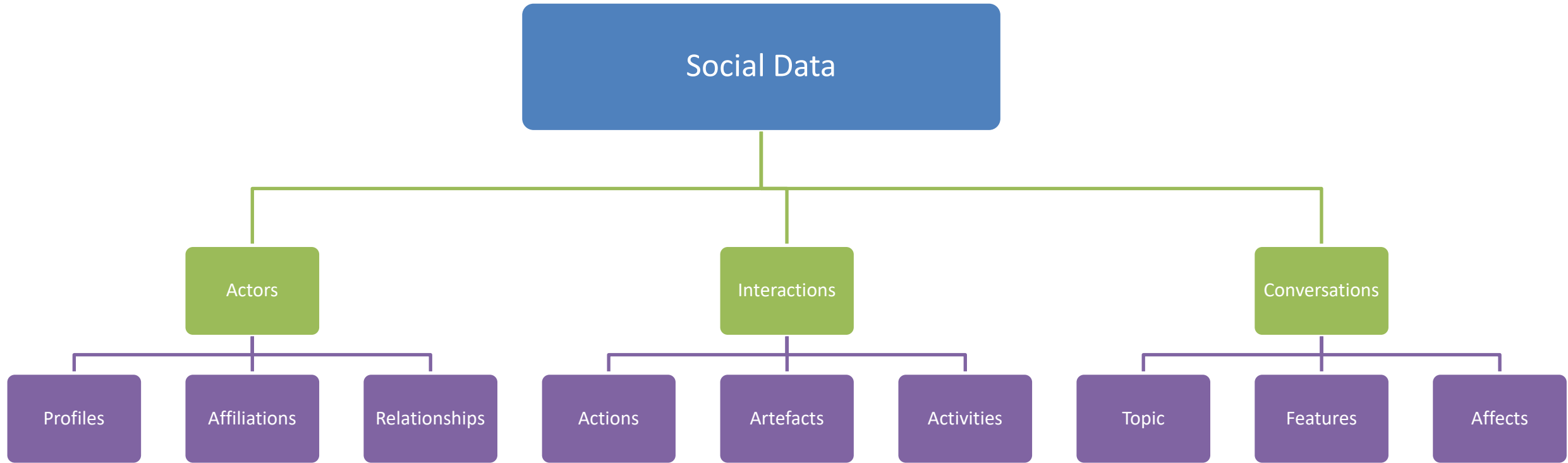
[https://en.wikipedia.org/wiki/On\\_the\\_Internet,\\_nobody\\_knows\\_you're\\_a\\_dog](https://en.wikipedia.org/wiki/On_the_Internet,_nobody_knows_you're_a_dog)



Ramu: "On the Facebook, everybody knows I am a dog"

**Pseudo-Anonymity → Real Identity**

# Conceptual Model: Big Social Data



# cbsBDA Framework for Big Data Analytics

## Meaningful Facts

Face Validity  
Blindingly Obvious  
Water Flows Downhill  
Makes Sense  
Doesn't Make Sense  
Interesting but Irrelevant  
Interesting and Important  
Contradictory  
Eureka!

## Actionable Insights

Continue Doing More  
Continue Doing Less  
Do Differently  
Start Doing New  
Stop Doing Old  
Do Not Ever Do

## Valuable Outcomes

Short-Term  
Medium-Term  
Long-Term

## Sustainable Impacts

People  
Planet  
Profit

## **Research Project: Roskilde Festival**

Data and Tools

Visual Analytics

*Text Analytics*

*Social Set Analysis*

# ROSKILDE FESTIVAL



# Research Streams & Objectives

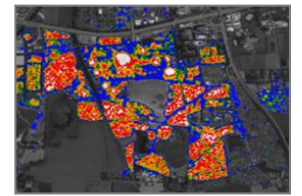
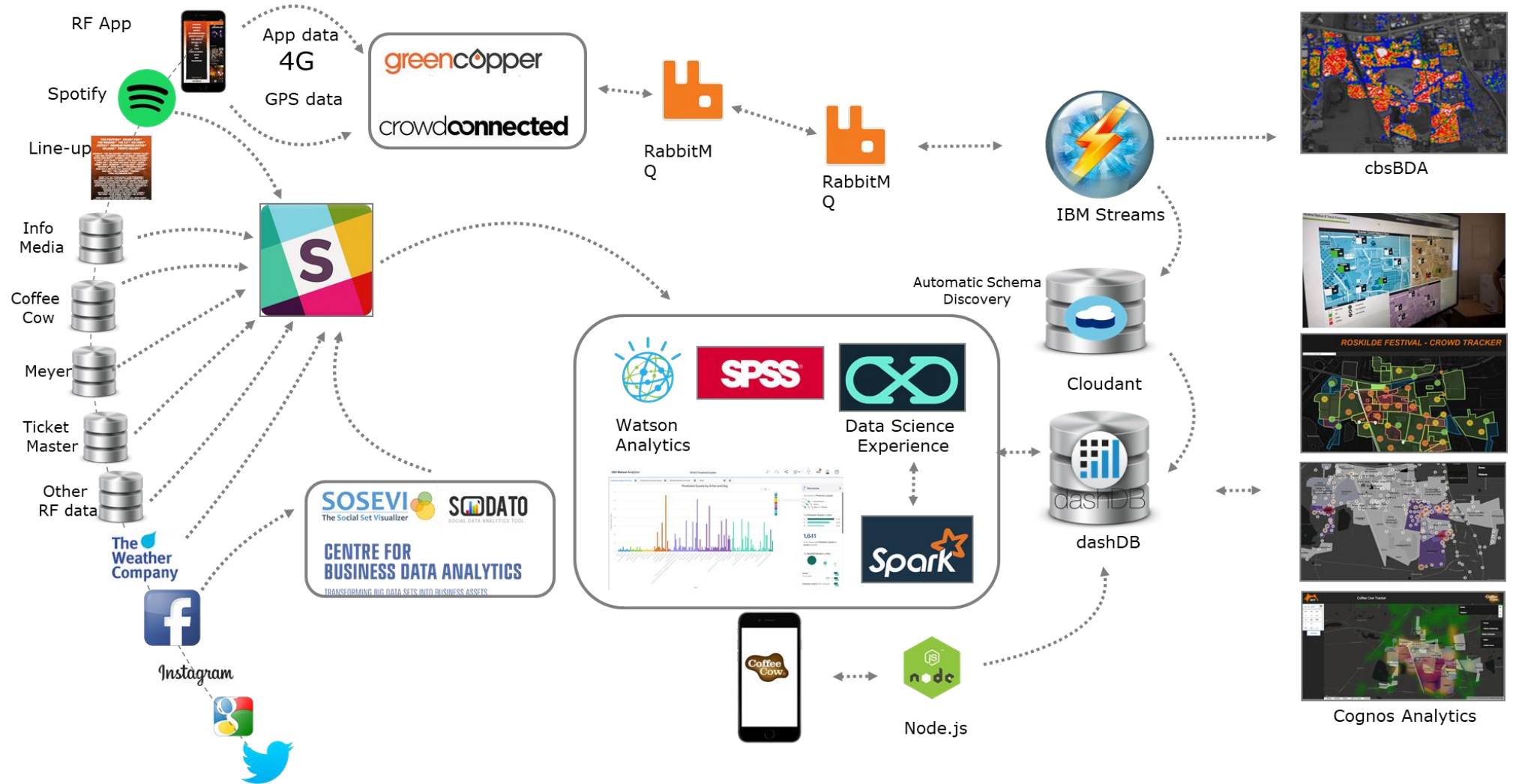
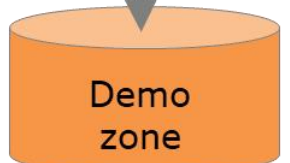
- ✦ Project #1: Geographies of Being, Sharing, and Feeling (RF-Social)
- ✦ Project #2: Roskilde Festival Time Use Analysis (RF-Time)
- ✦ Project #3: Human Physical Mobility at Roskilde Festival (RF-Movement)
- ✦ Project #4: Roskilde Festival User Clusters (RF-Clusters)
- ✦ Project #5: Roskilde Festival Predictive Analytics (RF/Meyers -Predict)
- ✦ Project #6: Volunteers profile and movements
- ✦ Project #7: iPhone versus Android (use, movements and attitudes)

# IT infrastructure - CBS BIG DATA LAB RF 2017

Rush hour: 1 GB/sec

## Governance

Ikke personhenførbare data



# Data & Tools

## Social Media Inventory of RF17



Name	Type	Country	Link	Fans	Twitter ID	Hashtag	Fetched Social/Follower
1. Roskilde	Festival	Denmark	https://www.facebook.com/rosvilde/	1024817703	@orangeholing	#RoskildeFest	
2. Østervold	Festival	US	https://www.facebook.com/ostervoldfestival/	402133893	@ostervold	#Østervold	
3. Østervold	Festival	Denmark	https://www.facebook.com/ostervoldfestival/	420180865	@ostervold	#Østervold	
4. Way Out West	Festival		https://www.facebook.com/wayoutwest/	2288213268	@wayoutwestuk	#WayOutWest	
5. Trossø Festival	Festival		https://www.facebook.com/trossoefestival/	133880881081	@trossoefest		
6. Slørø Festival	Festival	Denmark	https://www.facebook.com/slroefestival/	928052817			
7. Slørø Festival	Festival	Denmark	https://www.facebook.com/slroefestival/	235688115			
8. Slørø Festival (Skanderborg Festival)	Festival	Denmark	https://www.facebook.com/slroefestival/	2144073362			
9. Slørø	Festival	Denmark	https://www.facebook.com/slroefestival/	188292544	@Slorofestival		
10. Trossø	Festival	Denmark	https://www.facebook.com/trossoefestival/	48410112058			
11. Rock on Sine	Festival		https://www.facebook.com/rockonsine	157181835	@rockonsine	#Rockonsine	
12. Salsen	Festival		https://www.facebook.com/salsen/	1672007762	@salsen		
13. Burning Man	Festival		https://www.facebook.com/burningman/	688364261	@burningman		
14. SØNDR	Festival		https://www.facebook.com/sondr/	78393393	@sondr		
15. Øster	Festival		https://www.facebook.com/oster/	72324887			
16. Weecher	Festival		https://www.facebook.com/weecher/	104079266871	@RockWeecher		
17. Rock at Pargus	Festival		https://www.facebook.com/rockatpargus/	817033118	@RockAtPargus		
18. T in the Park	Festival		https://www.facebook.com/tinthepark/	87064887	@TinThePark		
19. Exit	Festival		https://www.facebook.com/exitfestival/	118162967	@ExitFestival		
20. Coachella	Festival		https://www.facebook.com/coachella/	202879947	@coachella		
21. Reading Festival	Festival		https://www.facebook.com/readingfestival/	2178712127	@ReadingFestival		
22. Sirge	Festival		https://www.facebook.com/sirge/	114622974	@sirgeofficial		
23. Pargus	Festival		https://www.facebook.com/pargus/	16376948028	@pargusfest		
24. Rock Festival	Festival		https://www.facebook.com/rockfestival/	614181798	@rockfestival		
25. Northside	Festival	Denmark	https://www.facebook.com/northside/	107410281371	@NorthsideFest		
26. Reading Festival	Festival		https://www.facebook.com/readingfestival/	3718712127	@ReadingFestival		
27. Rock on Ring	Festival		https://www.facebook.com/rockonring/	140242875	@rockonring		
28. Summerjam	Festival		https://www.facebook.com/summerjam/	484485178	@summerjam		
29. Baltic Sea Jazz Valley	Festival		https://www.facebook.com/balticseajazzvalley/	167701402113	@BalticSeaJazzValley		
30. Ultra Music Festival	Festival		https://www.facebook.com/ultramusic/	2767102738	@ultra		
31. Baker Beach TV	Festival		https://www.facebook.com/bakerbeachtv/	16481368719	@bakerbeachtv		
32. De Montfort Festival	Festival	Netherlands	https://www.facebook.com/demontfortfestival/	16020088885	@demontfort		
33. Who The Valley Festival	Festival		https://www.facebook.com/whoth valleyfestival/	146820185450	@whothvalley		
34. Dimensions Festival	Festival		https://www.facebook.com/dimensionsfestival/	158869191481	@Dimensions_Fest		
35. Drenth City	RF	Netherlands	https://www.facebook.com/drenthcity/	186349110871			
36. Clean Oil Land			https://www.facebook.com/cleanoilland/	15749466009	@CleanOilLand		
37. FOOD FIGHTERS US	Band		https://www.facebook.com/foodfighters/	202869744	@FOODFIGHTERS_US		
38. ARCADE FIRE CA	Band		https://www.facebook.com/arcadefire/	1521278224	@arcadefire		
39. THE WELSH CA	Band		https://www.facebook.com/welshca/	29238266842	@thewelshca		
40. THE BRICKS	Band		https://www.facebook.com/thebricks/	102466501	@The_brick		
41. ICE CUBE US	Band		https://www.facebook.com/icecube/	218732824	@IceCube_US		
42. JUSTICE US	Band		https://www.facebook.com/justiceband/	288203116	@justice		
43. MODERN SKOLAR featuring MODERNE SKOLAR	Band		https://www.facebook.com/modernskolar/	537708712	@ModernOfficial		
44. BOLLANDS US	Band		https://www.facebook.com/bollands/	242229948	@bollands_labour		
45. THE WIZARDS US DE	Band		https://www.facebook.com/wizards/	220200264	@wizards		



Artist Facebook Dashboard



Foo Fighters



Awesome Fighters Glastonbury Please Taylor Thanks amazing awesome better coming concert fighters fucking people please really should that's ticket tickets

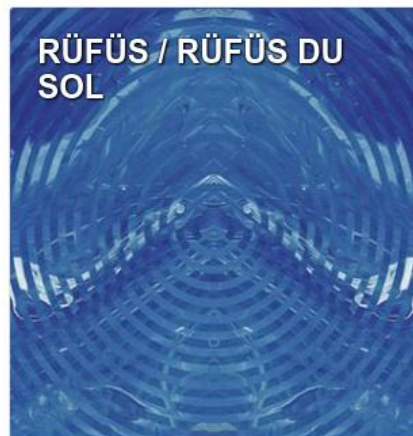


Cashmere Cat

Two hundred channels and nothing but cats.



Absolutely Agreed Amazing Ariana Awesome Cashmere Thanks absolutely already beautiful cashmere comment correct features listen please really thanks totally wedding



RÜFÜS / RÜFÜS DU SOL



Friday Please actually amazing another awesome better coming excited festival lineup playing please should that's though ticket tickets weekend you're



RED FANG



Awesome Brazil Congrats Fighters Fucking Hellfest Please Poland Thanks That's amazing awesome coming deserved favorite fucking opening please should videos



Blood Command



Absolutely Amazing Australia Awesome Karina Really Release Sounds Thanks albumet already chorus excited forward listen really record release sometime spotify



The Rumour Said Fire



Cancer



Romperayo

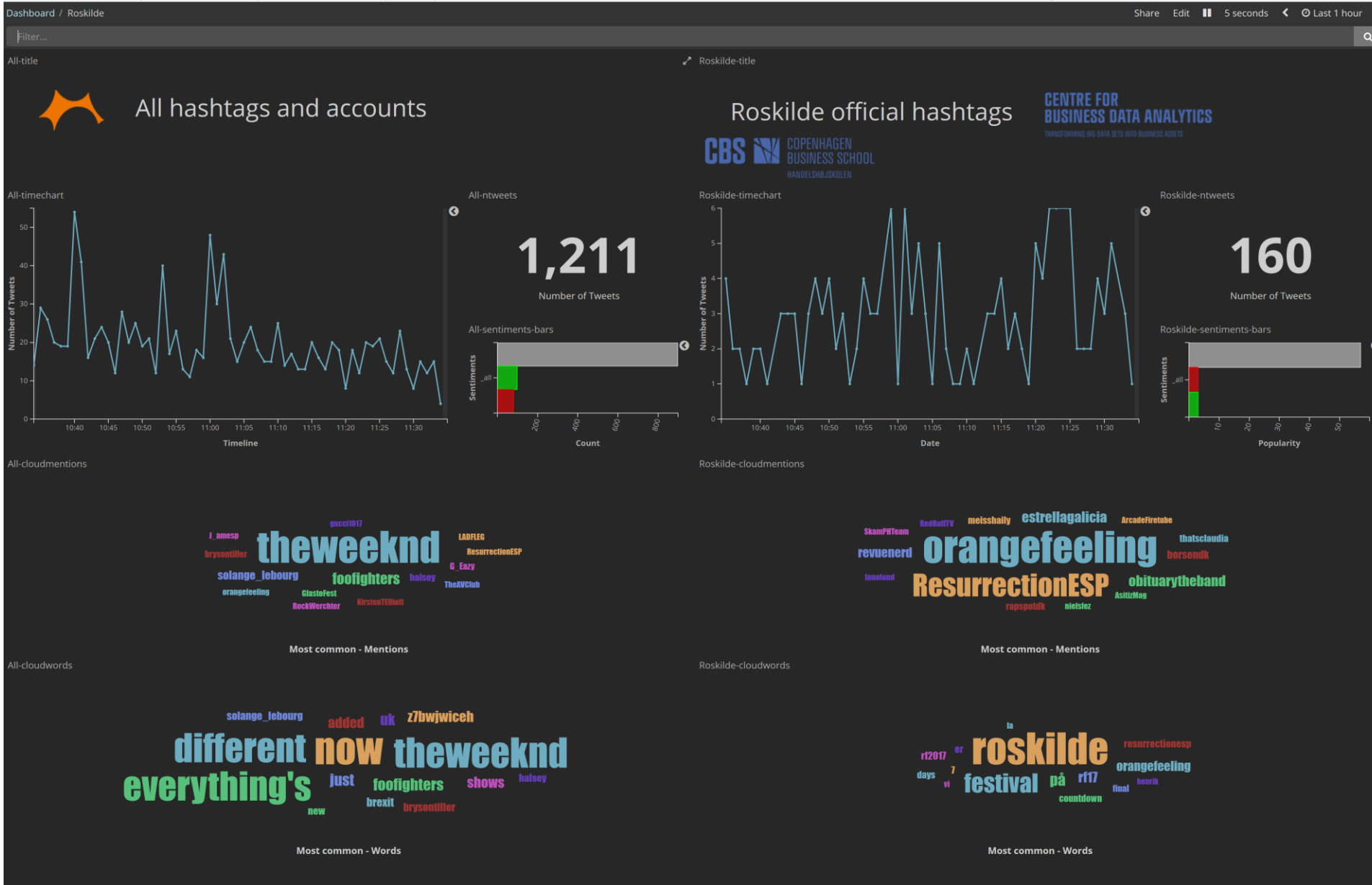


Botany

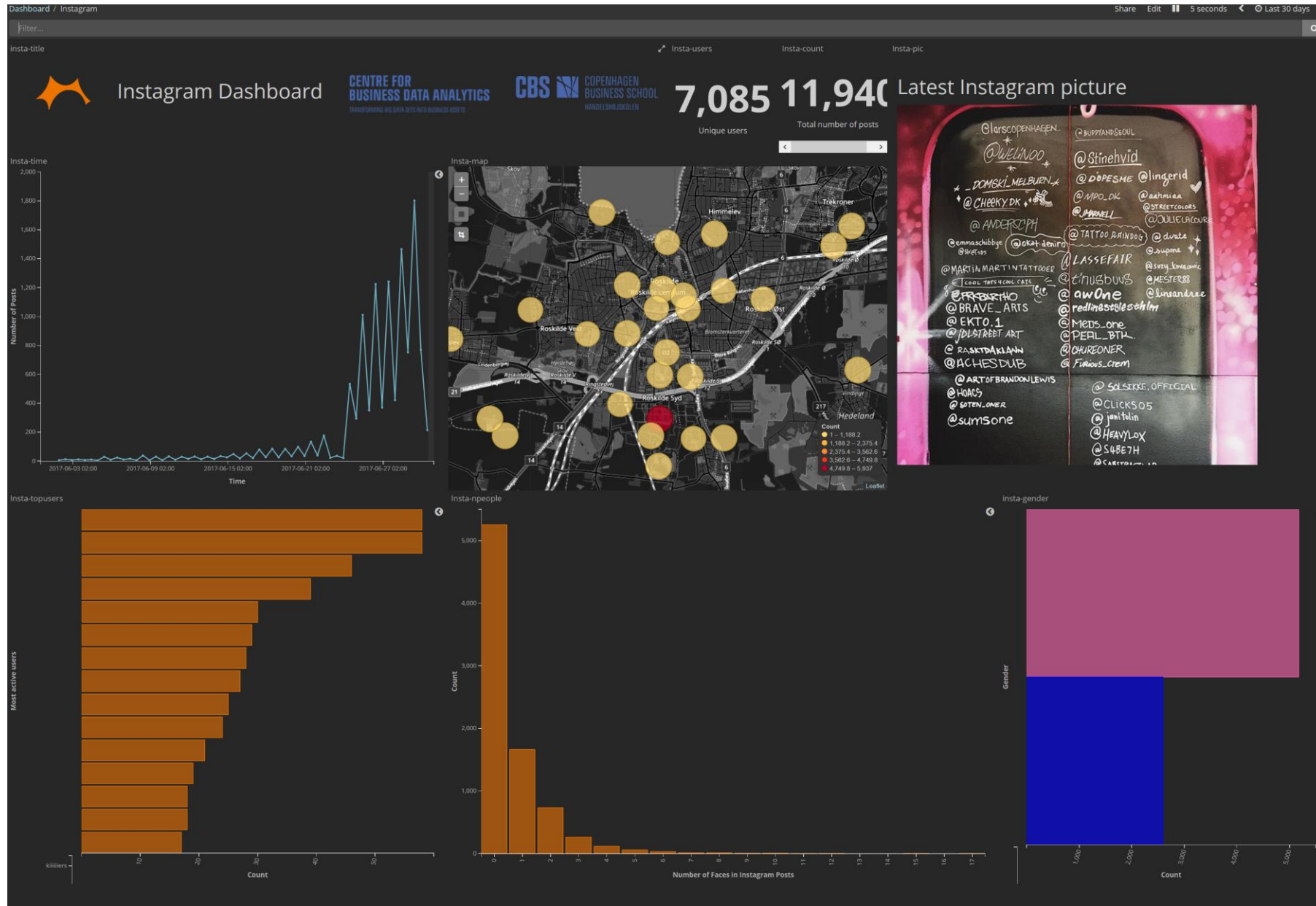


Boujeloud

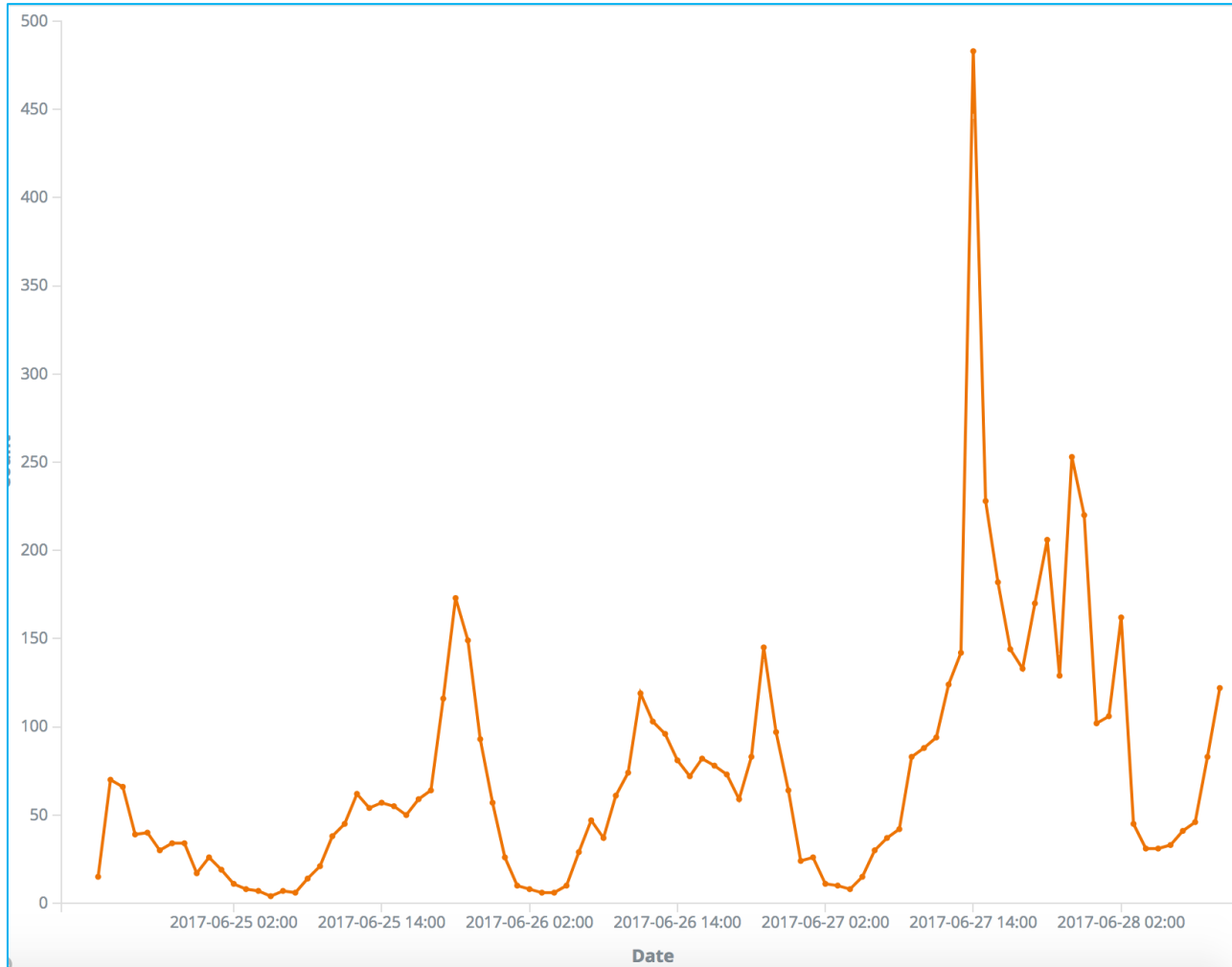
# Visual Analytics: Dashboards: Twitter



# Visual Analytics: Dashboards: Instagram



# Visual Analytics: Twitter: Roskilde Festival



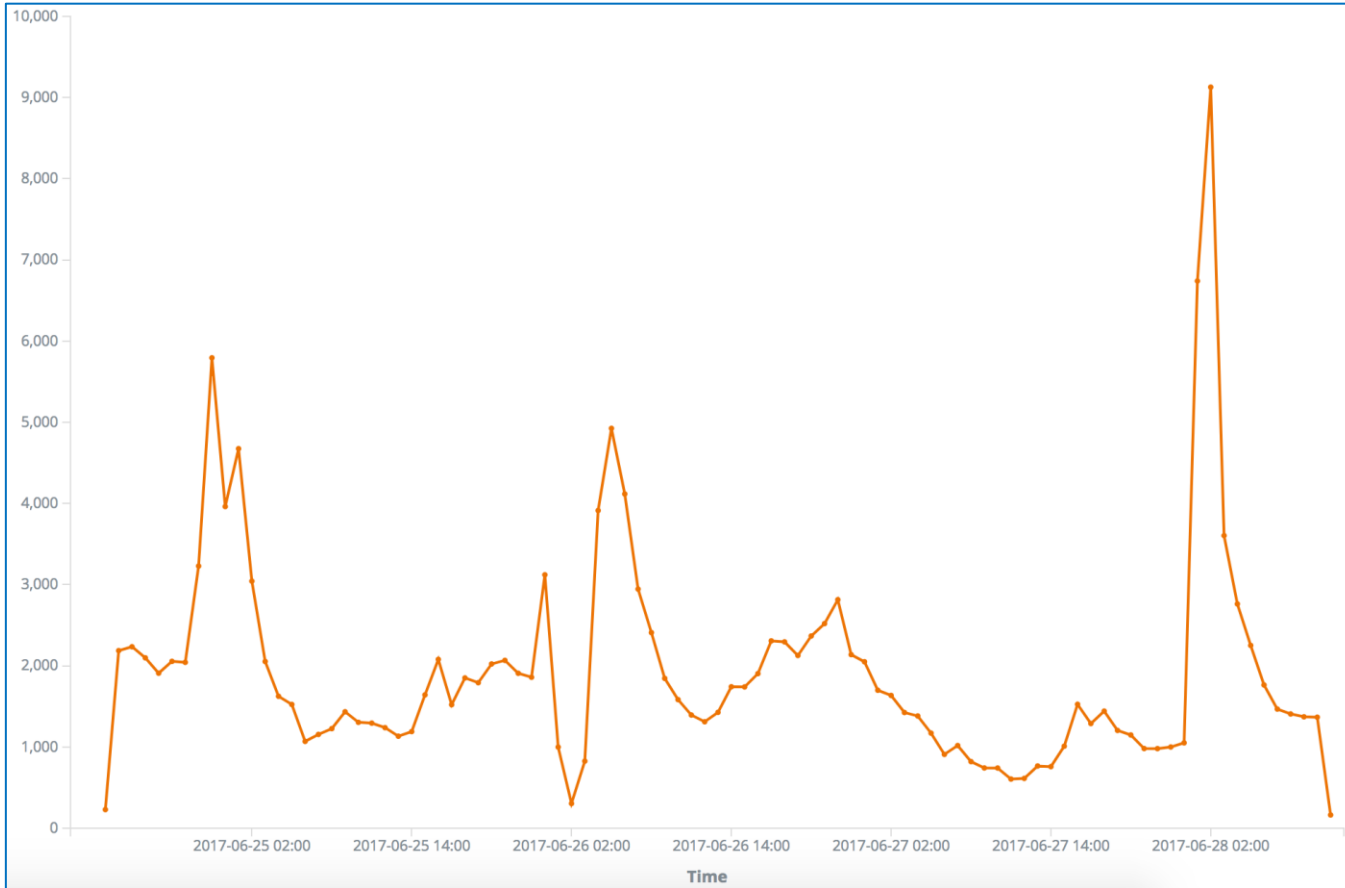
## Most mentioned accounts

estrellagalicia  
ResurrectionESP  
t\_wittenburg SKAMLATAM  
je5perl **ubersap** lushsux  
**orangefeeling**  
noedhjaelp ISAKxEVEN  
thatsclaudia exp\_edition  
PortalSkamBR  
MikkelMinor  
Tomato\_TJ\_HH

## Most common words

boys brugerne  
rf17 1  
orangefeeling  
**roskilde**  
days festival er  
believe på 7 belgium  
gotta bicycle

# Visual Analytics: Twitter: RF17: Artists



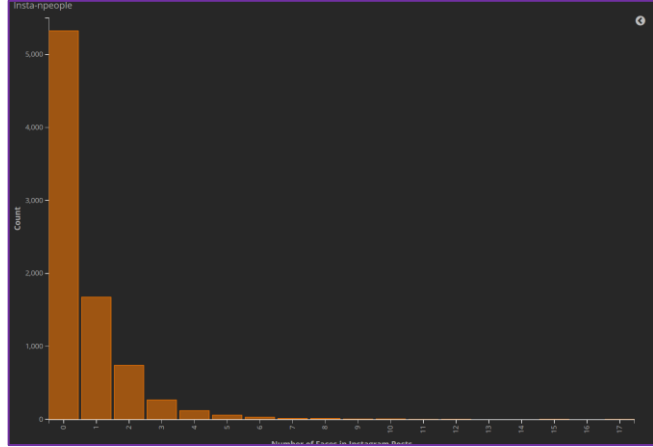
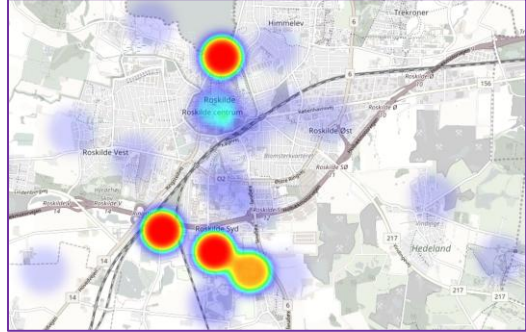
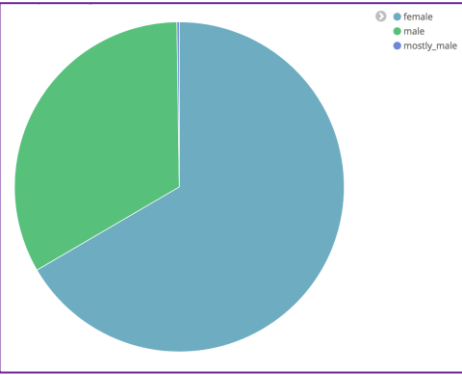
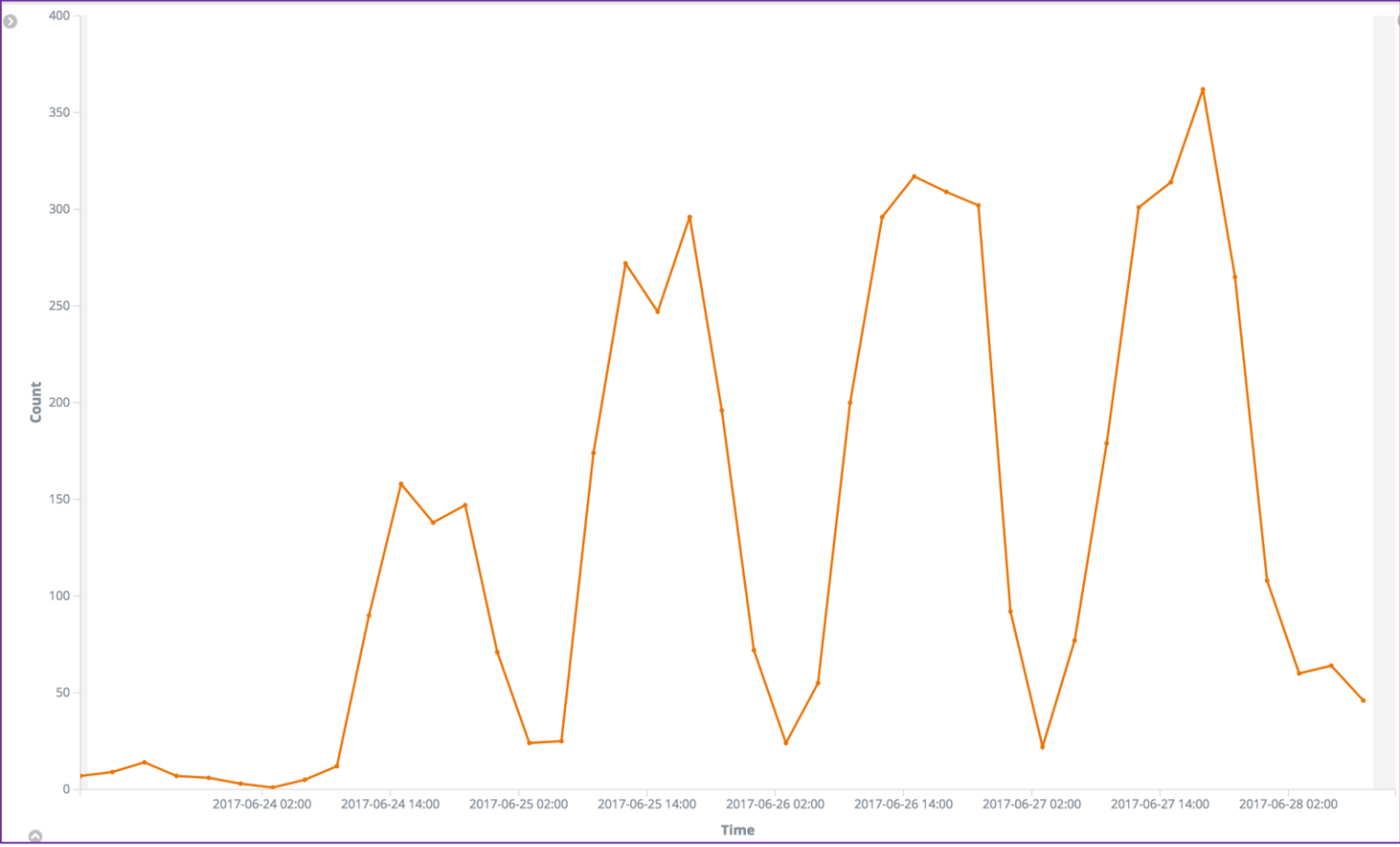
Most mentioned accounts



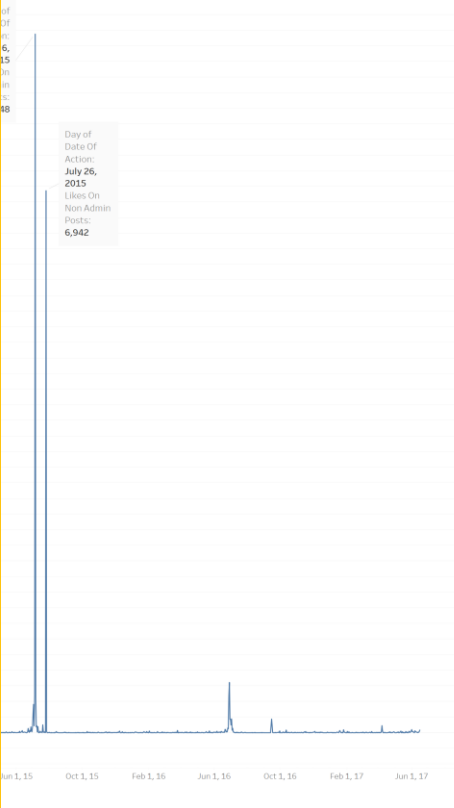
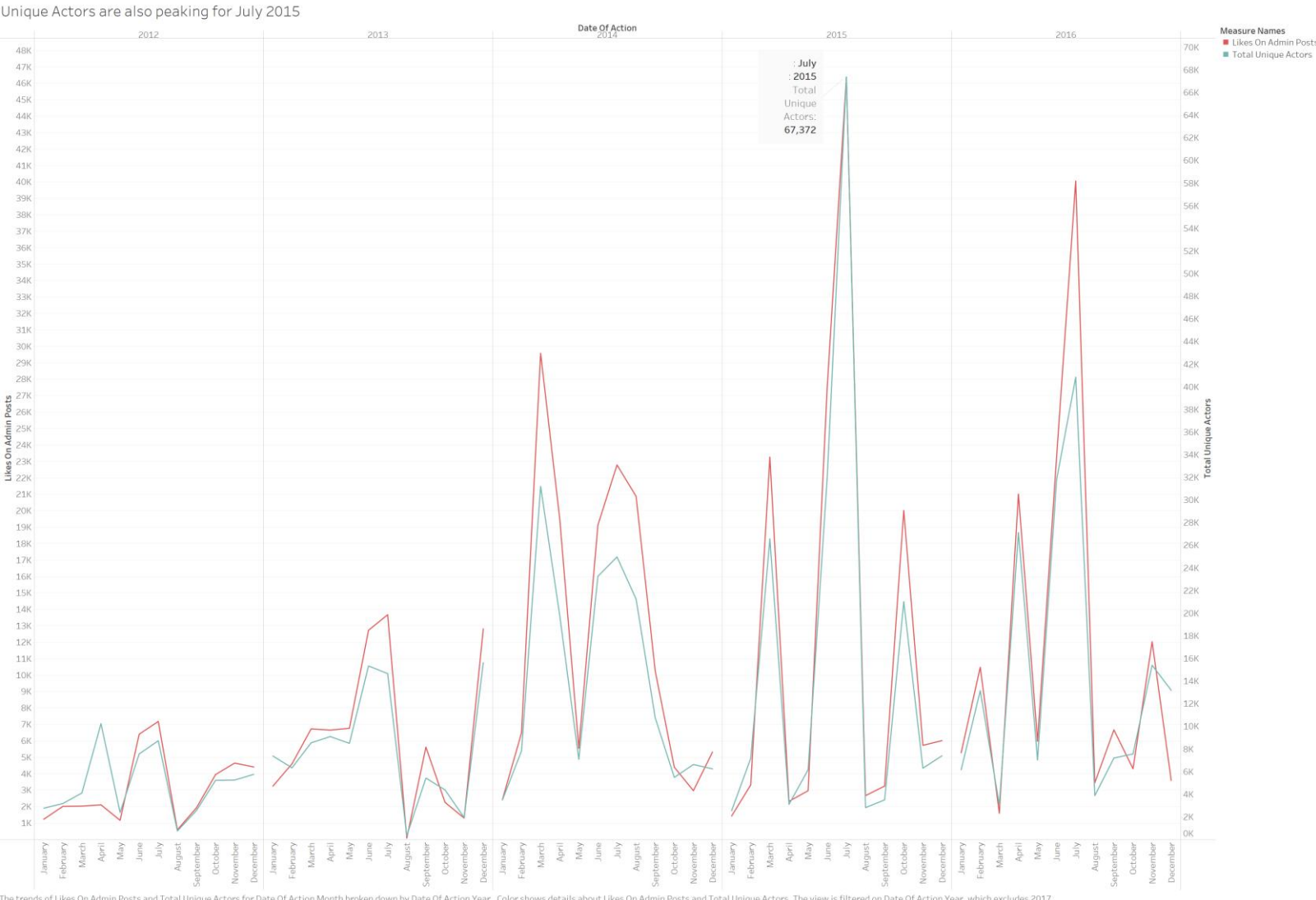
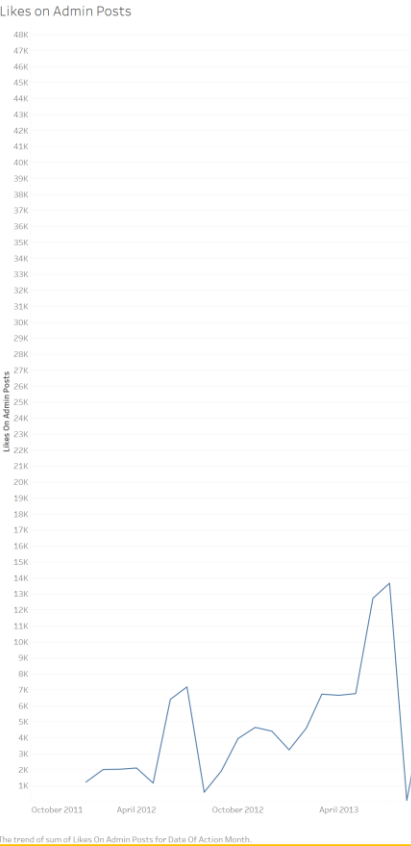
Most common words



# Visual Analytics: Instagram: Roskilde Festival

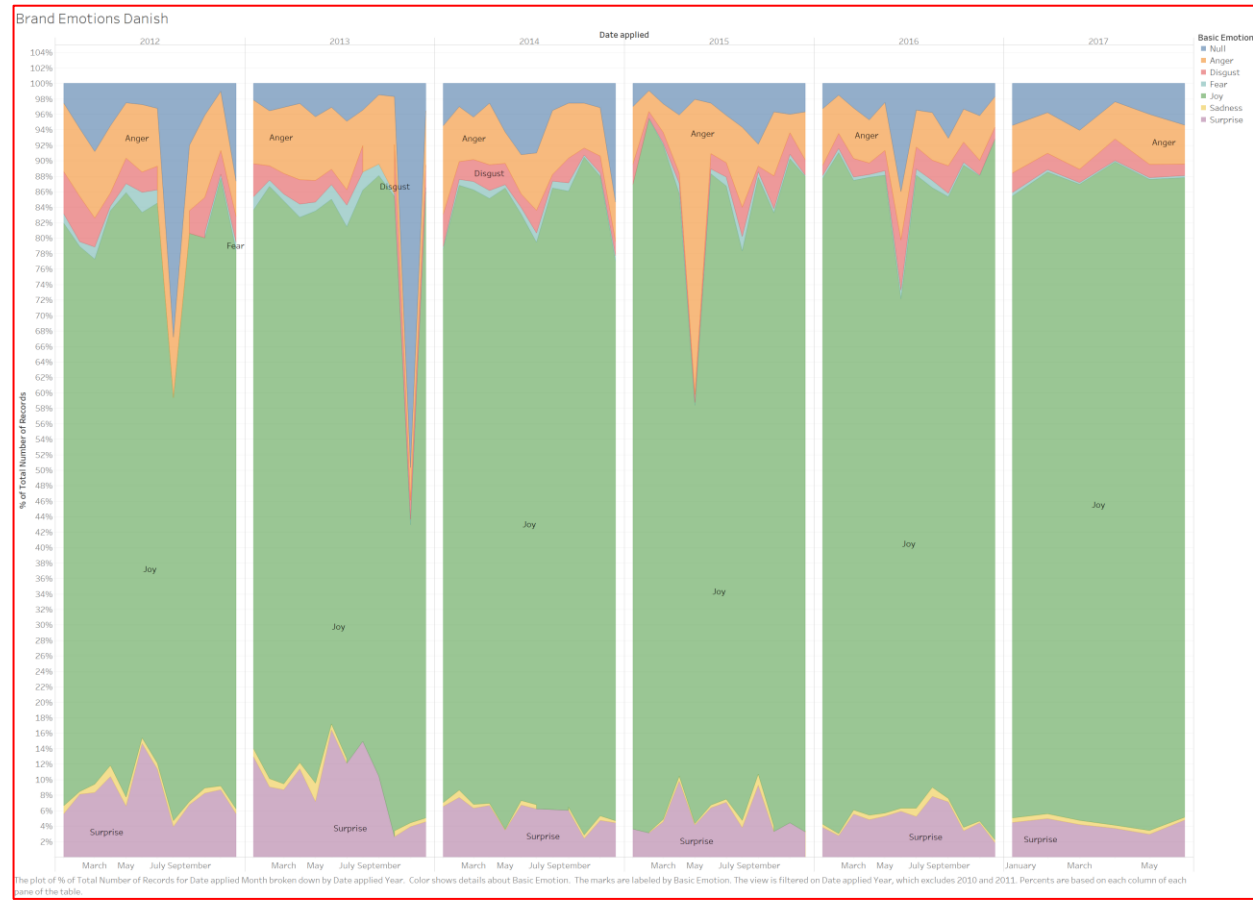
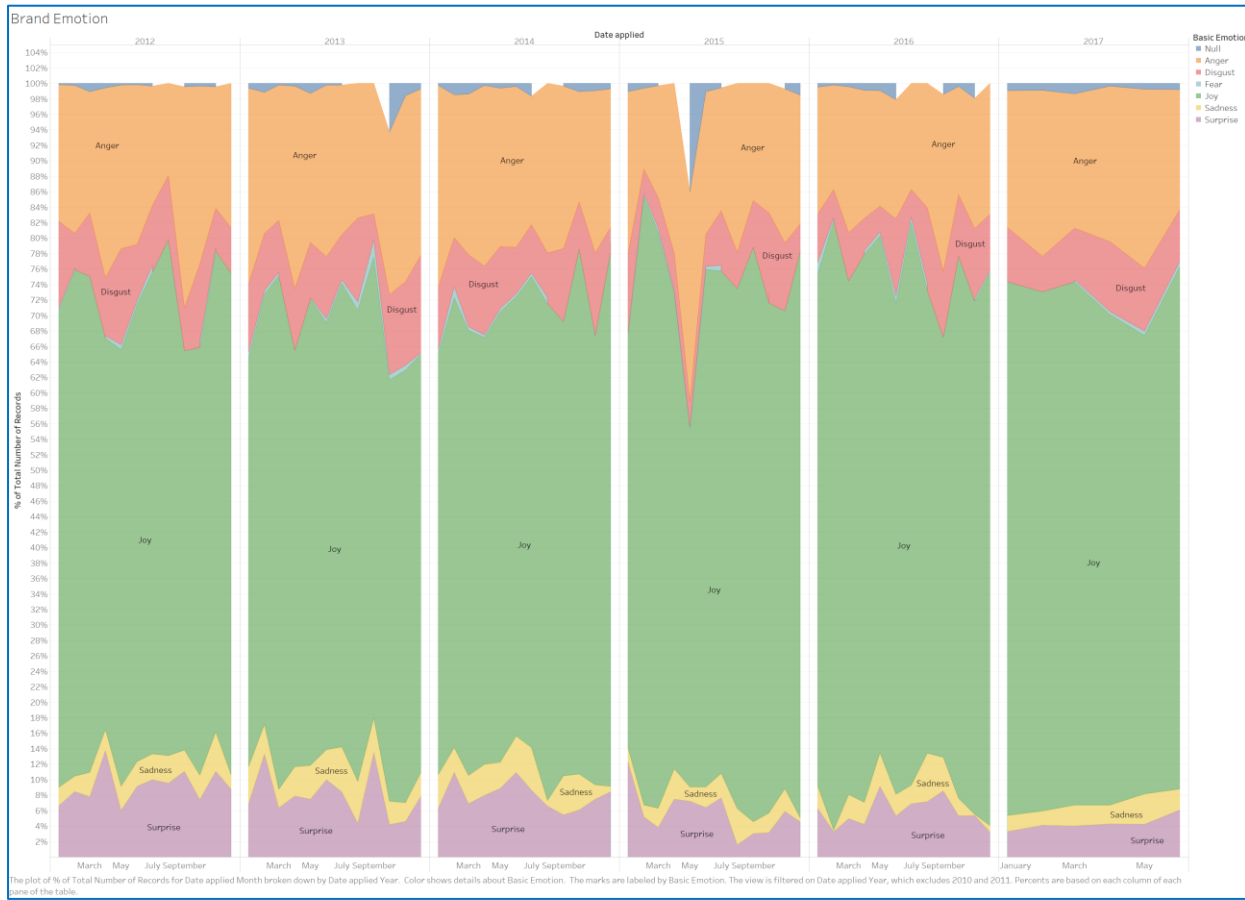


# Visual Analytics: Facebook: Roskilde Festival (2012-2017)

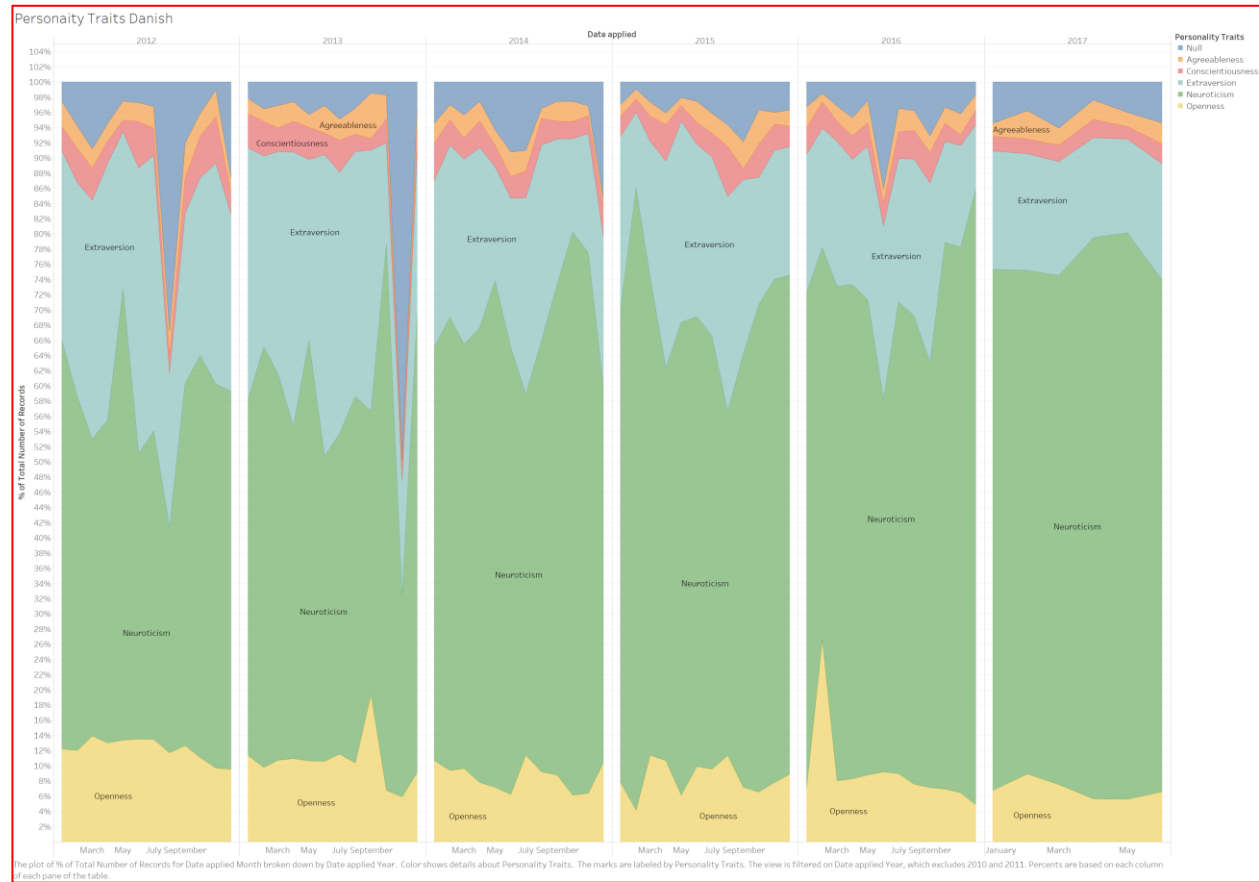
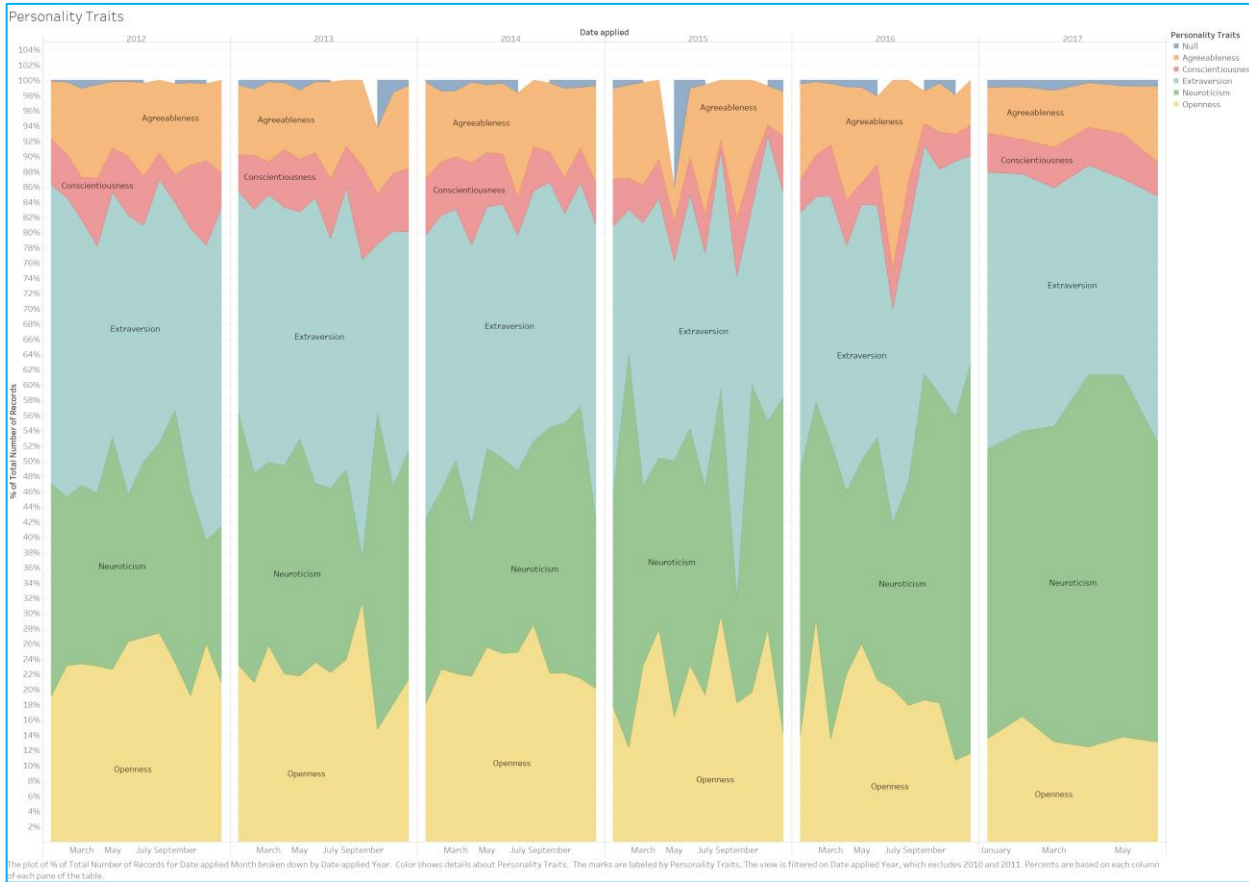


The trends of Likes On Admin Posts and Total Unique Actors for Date Of Action Month broken down by Date Of Action Year. Color shows details about Likes On Admin Posts and Total Unique Actors. The view is filtered on Date Of Action Year, which excludes 2017.

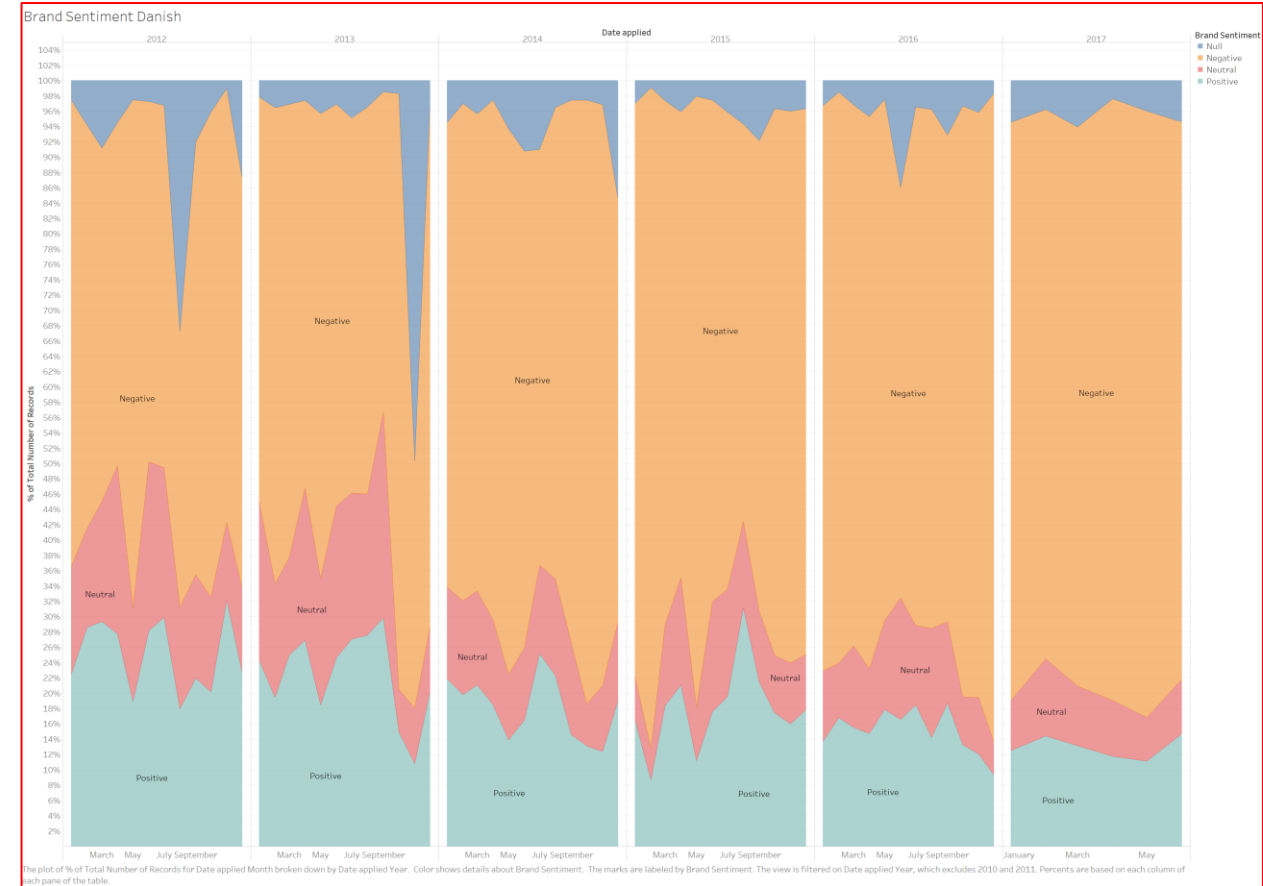
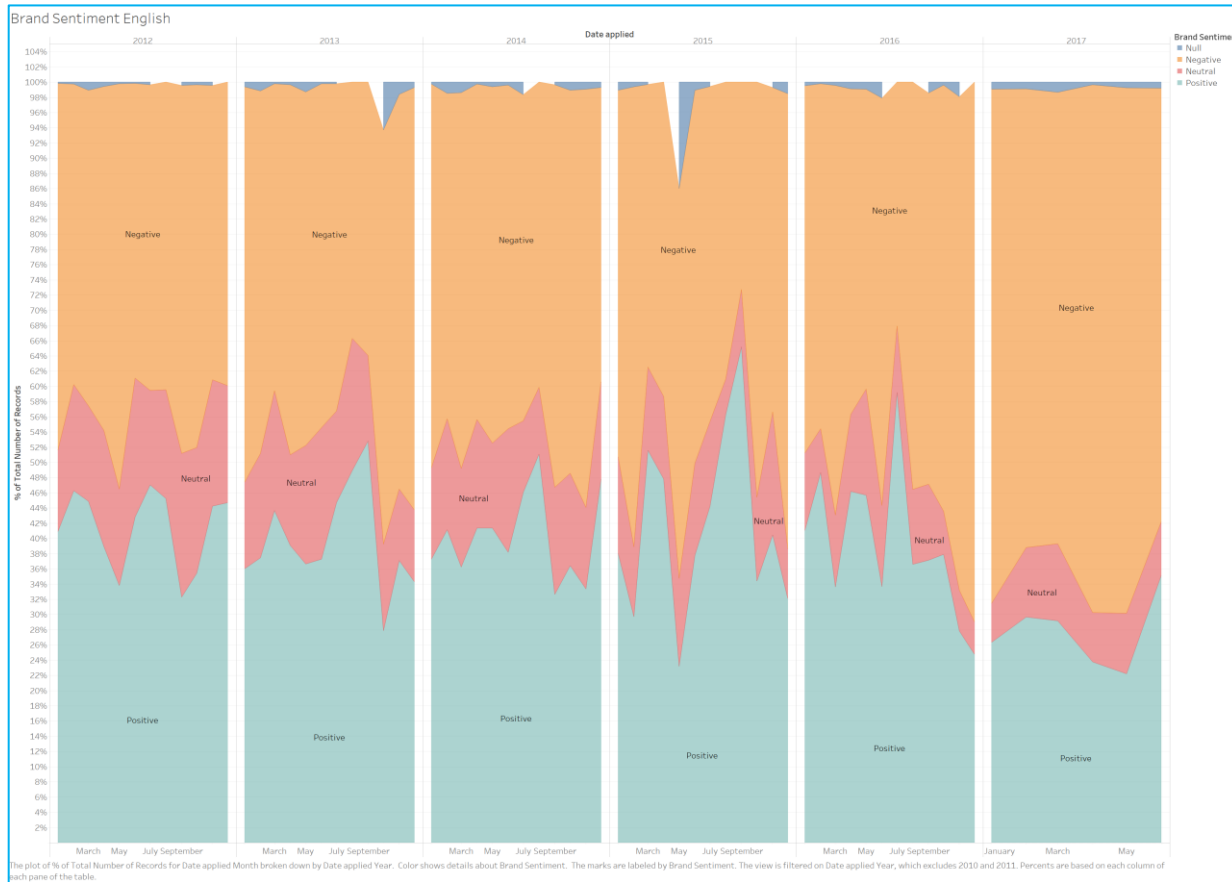
# Text Analytics: Facebook: Roskilde Festival (2012-2017): Six Basic Emotions: English vs. Danish



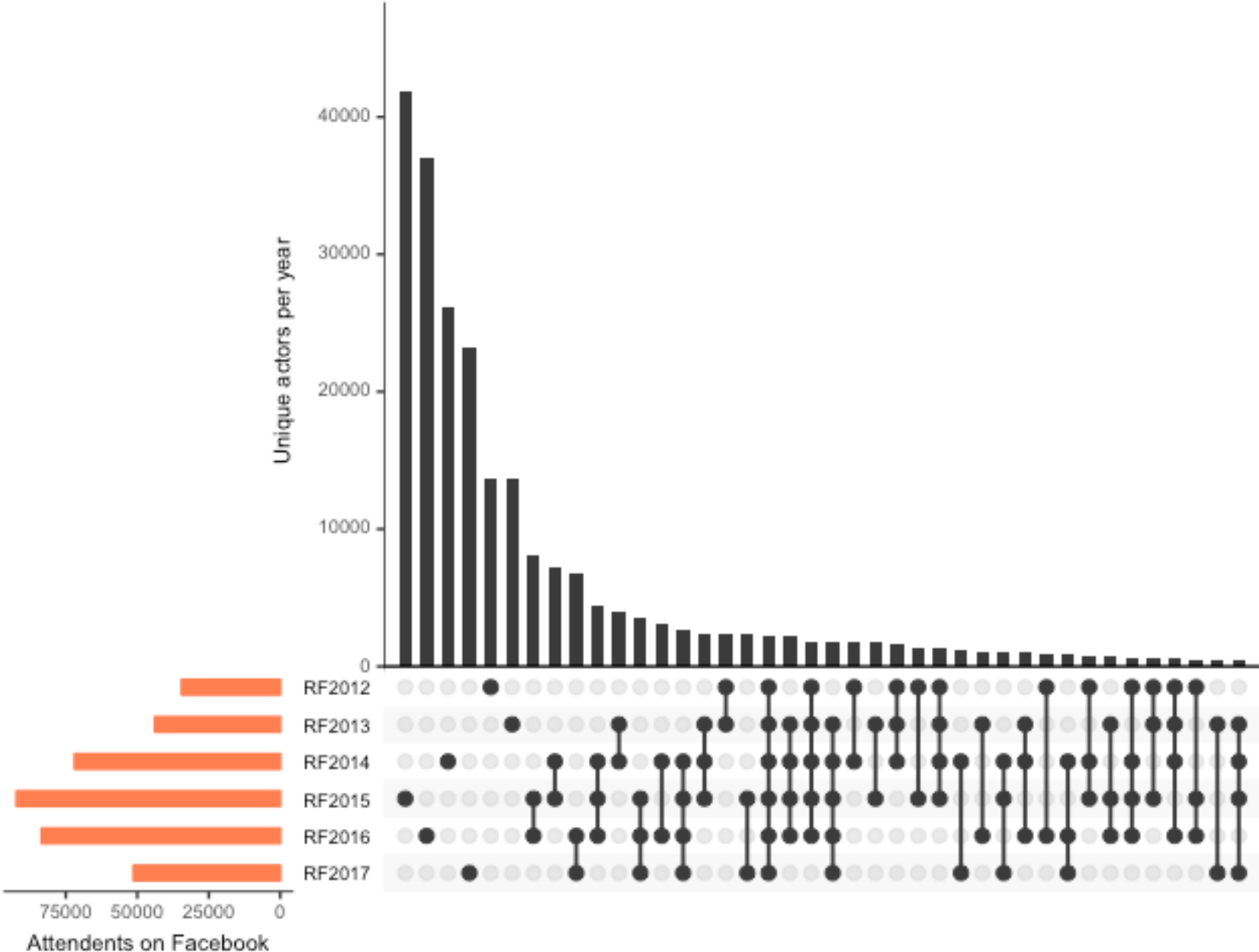
# Text Analytics: Facebook: Roskilde Festival (2012-2017): Personality Types: English vs. Danish



# Text Analytics: Facebook: Roskilde Festival (2012-2017): Brand Sentiment: English vs. Danish



# Social Set Analysis: Facebook: Users: RF 2012-2017



# Social Set Analysis: Facebook: Users: RF17 Artists vs. Roskilde Festival

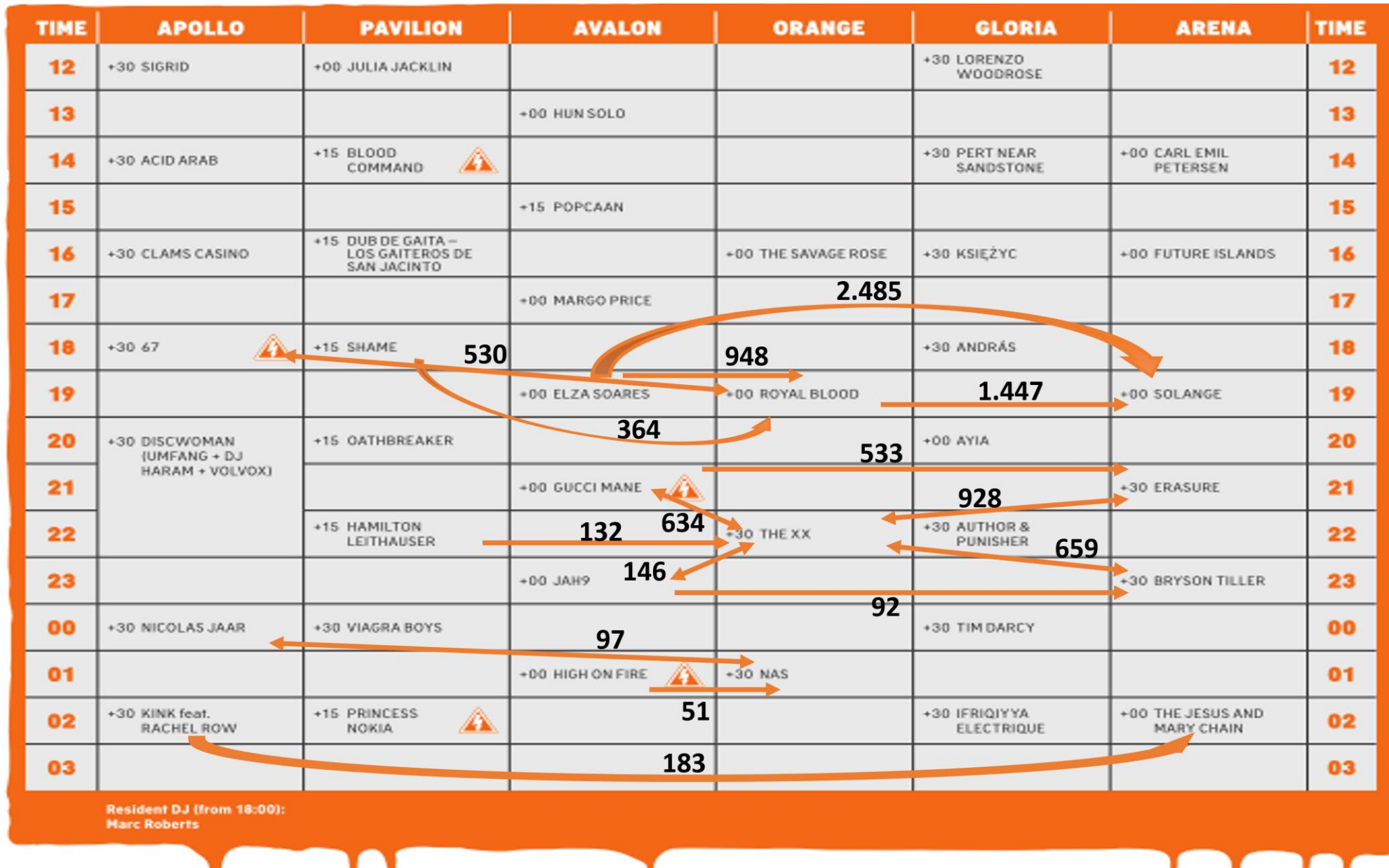
artist_1_name	artist_1_num_u	artist_1_percent_overlap	overlap	artist_2_name	artist_2_num_u	artist_2_percent_overlap
Foo Fighters	453,726	0.96%	4,352	Roskilde Festival	155,202	2.80%
Blood Command	1,563	9.60%	150	Roskilde Festival	155,202	0.10%
RED FANG	14,458	1.80%	260	Roskilde Festival	155,202	0.17%
Botany	602	0.83%	5	Roskilde Festival	155,202	0.00%
Boujeloud	203	33.50%	68	Roskilde Festival	155,202	0.04%
Cancer	897	35.90%	322	Roskilde Festival	155,202	0.21%
Cashmere Cat	25,102	1.84%	462	Roskilde Festival	155,202	0.30%
Romperayo	388	3.35%	13	Roskilde Festival	155,202	0.01%
RÃœFÃœS / RÃœFÃœS DU SOL	27,644	1.06%	294	Roskilde Festival	155,202	0.19%
The Rumour Said Fire	2,922	23.07%	674	Roskilde Festival	155,202	0.43%
Circuit des Yeux	85	0.00%	-	Roskilde Festival	155,202	0.00%
Clams Casino	5,013	1.08%	54	Roskilde Festival	155,202	0.03%
Show Me The Body	1,839	1.31%	24	Roskilde Festival	155,202	0.02%
Sigrid	9,857	4.13%	407	Roskilde Festival	155,202	0.26%
Cult of Luna	8,952	2.40%	215	Roskilde Festival	155,202	0.14%
SVIN	443	33.18%	147	Roskilde Festival	155,202	0.09%
Trap Them	2,002	2.35%	47	Roskilde Festival	155,202	0.03%
Debashish Bhattacharya	2,567	0.39%	10	Roskilde Festival	155,202	0.01%
Discwoman	5,394	1.32%	71	Roskilde Festival	155,202	0.05%
Vanishing Twin	798	1.88%	15	Roskilde Festival	155,202	0.01%
Warpaint	19,731	1.42%	281	Roskilde Festival	155,202	0.18%
Los Gaiteros de San Jacinto	1,238	1.13%	14	Roskilde Festival	155,202	0.01%
Elza Soares	79,159	0.39%	306	Roskilde Festival	155,202	0.20%
Emil Stabill	5,015	36.15%	1,813	Roskilde Festival	155,202	1.17%
WIKI	2,780	1.26%	35	Roskilde Festival	155,202	0.02%
Fatima Yamaha	3,924	1.53%	60	Roskilde Festival	155,202	0.04%
Young M.A	176,726	0.20%	348	Roskilde Festival	155,202	0.22%
First Hate	2,604	18.93%	493	Roskilde Festival	155,202	0.32%

# Social Set Analysis: Facebook: Users: RF17: Schedule: Wednesday

TIME	APOLLO	PAVILION	AVALON	ORANGE	GLORIA	ARENA	TIME
17	+15 YOUNG M.A.	<b>3.046</b>	+30 A DAY TO REMEMBER ⚡		+30 VANISHING TWIN		17
18		+15 IDLES ⚡		+00 PHLAKE		+00 WARPAINT	18
19	+15 RÜFÜS		+30 ALSARAH & THE NUBATONES				19
20		+15 MARCHING CHURCH		<b>85</b>	+00 MADAME GANDHI	+30 G-EAZY	20
21	+15 BICEP	<b>111</b>	+30 RED FANG				21
22		+15 KEVIN MORBY	<b>168</b>	<b>432</b>	+00 THE WEEKND	+00 75 DOLLAR BILL	22
23	+00 BONOBO		+30 RAG'N'BONE MAN	<b>2.679</b>			23
00		+00 HAMID EL KASRI GNAOJA ENSEMBLE feat. JUSTIN ADAMS					00
01				+00 JUSTICE ⚡			01

Resident DJ (from 18:00):  
Marc Roberts

# Social Set Analysis: Facebook: Users: RF17: Schedule: Thursday



# Social Set Analysis: Facebook: Users: RF17: Schedule: Friday

TIME	APOLLO	PAVILION	AVALON	ORANGE	GLORIA	ARENA	TIME
12	+00 FIRST HATE	+15 NILS BECH			+30 '68		12
13			+00 CANCER			+00 TIVOLI COPENHAGEN PHIL	13
14	+00 NONAME	+15 KAREN ELSON			+30 SVIN		14
15			+00 KARL WILLIAM				15
16	+00 47SOUL	+15 OF MICE & MEN ⚠️		+00 SEUN KUTI & EGYPT 80 feat. YASHIN BEY	+30 HIEROGLYPHIC BEING	+00 TINASHE	16
17			+00 ANGEL OLSEN				17
18	+00 FATIMA YAMAHA	+15 AFENGINN			+30 ALEX CAMERON		18
19			+00 MATS GUSTAFSSON'S NU ENSEMBLE "HIDROS ZAP"	+00 FATHER JOHN MISTY		+00 AGAINST ME!	19
20	+00 MØME	+15 MAMMÚT			+30 BOTANY		20
21			+00 LA MAMBANEGRA			+00 TRENTEMØLLER	21
22	+00 KANO ⚠️	+15 BASOKIN		+00 FOO FIGHTERS	+30 BOUJELOUD		22
23			+00 JAGWAR MA			+30 LORDE	23
00	+00 THE AVALANCHES	+15 WIKI			+15 BCUC		00
01			+30 CULT OF LUNA	+15 DEN SORTE SKOLE			01
02	+30 AV AV AV	+15 MOON DUO			+00 NOGA EREZ	+00 ICONA POP	02
03							03

Resident DJ (from 18:00):  
Foozool

# Social Set Analysis: Facebook: Users: RF17: Schedule: Saturday

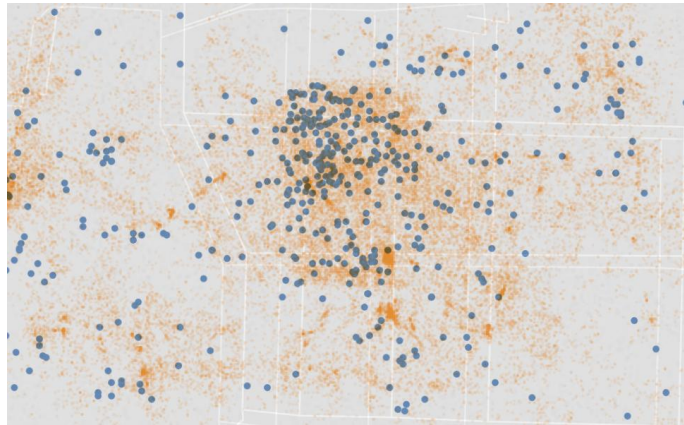
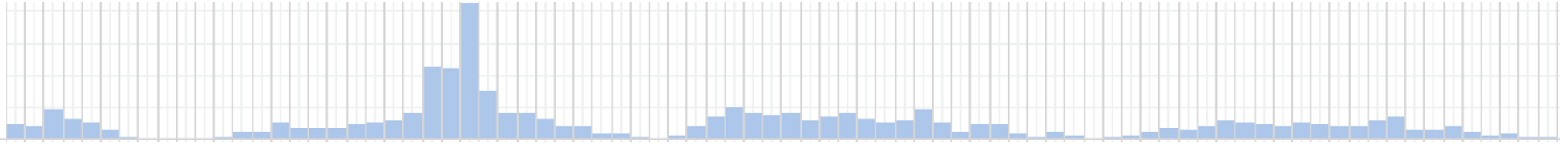
TIME	APOLLO	PAVILION	AVALON	ORANGE	GLORIA	ARENA	TIME
12		+15 PIG DESTROYER ⚠️	+30 THE RUMOUR SAID FIRE		+30 DEBASHISH BHATTACHARYA		12
13	+00 IBAAKU						13
14		+15 AARON LEE TASJAN	+30 DIGABLE PLANETS		+30 CIRCUIT DES YEUX	+00 EMIL STABIL	14
15	+00 BJARKI						15
16		+15 FULL OF HELL ⚠️	+15 JENNY HVAL	+00 THE LUMINEERS	+30 BLACK STRING	+00 KELLERMENSCH	16
17	+00 KREPT & KONAN ⚠️						17
18		+15 TRAP THEM ⚠️	+00 SLOWDIVE		+30 JANKA NABAY & THE BUBU GANG	+30 HALSEY	18
19	+30 CASHMERE CAT						19
20		+15 PRIESTS	+00 NEUROSIS		+30 ROMPERAYO		20
21	+30 PLAYBOI CARTI					+15 ANTHRAX ⚠️	21
22		+15 GROUP DOUEH & CHEVEU	+00 BAIANASYSTEM	+00 ARCADE FIRE	+30 PH/MR PETER HAYDEN BAND		22
23	+30 NOISIA 'OUTER EDGES' ⚠️				+45 ORANSSI PAZUZU	+30 RESIDENTE	23
00		+15 SHOW ME THE BODY ⚠️	+00 BABY WOODROSE	+30 MODERAT/ MODESELEKTOR			00
01					+15 ATOMIKYLÄ		01
02			+00 FREDDIE GIBBS			+00 SORT SOL	02
03							03

Resident DJ (from 18:00):  
Jamz Supernova

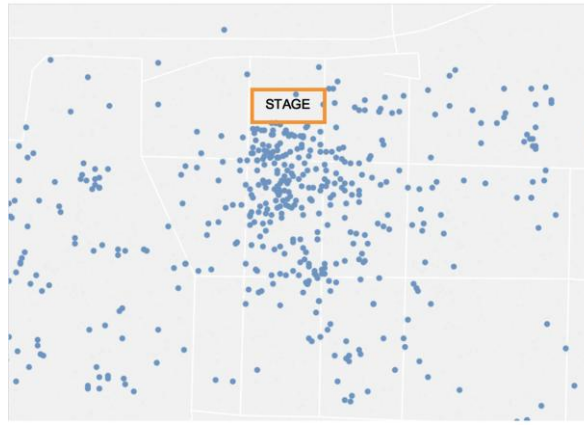
Annotations: 119, 93, 610, 160, 5.111, 146, 151

# Geographies of Being, Sharing, and Feeling

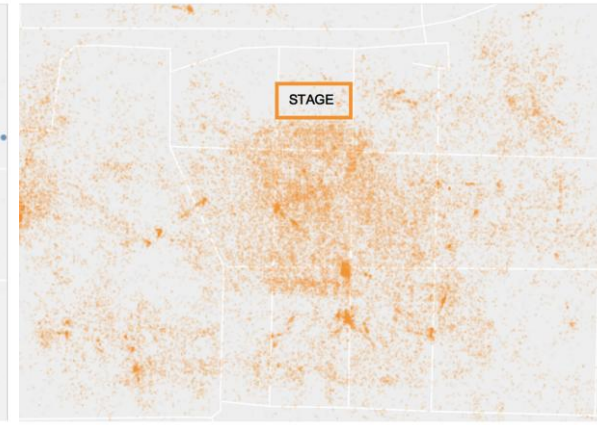
Florence and the Machine



PHOTOS / GEOSOCIAL POSTS



MOBILE PRESENCE



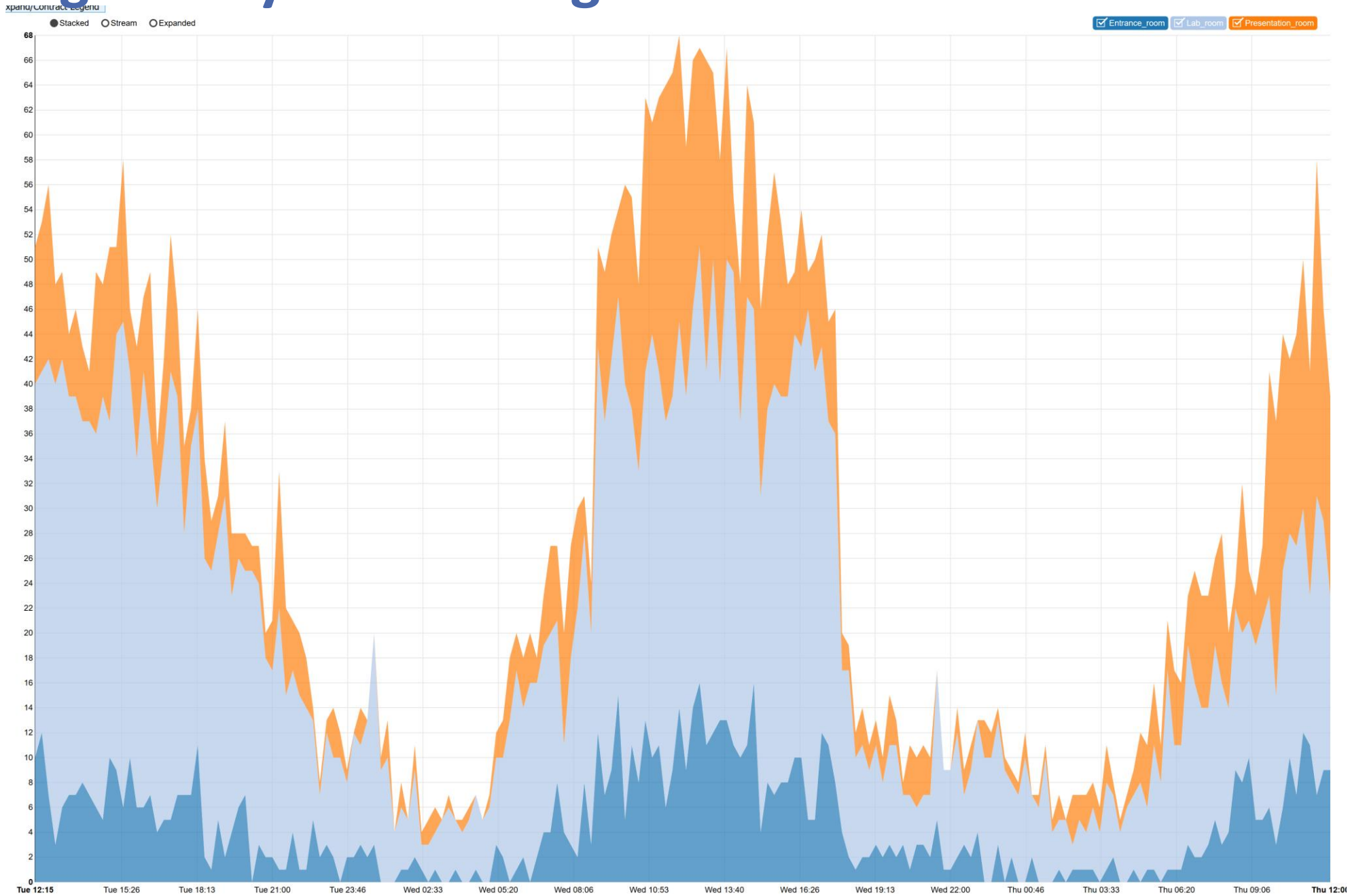
**Feeling:** how people experience RF17 in terms of emotions, feelings and sentiments (happy, sad, amusing etc.)

**Sharing:** what people find important, interesting, and/or relevant to share on social media about RF17

**Being:** where people are present (Orange Stage, Camping etc.)

# Roskilde Festival 2015-2018: Geospatial Analysis

# Building Usage Analytics: CBS Big Data Lab 2017

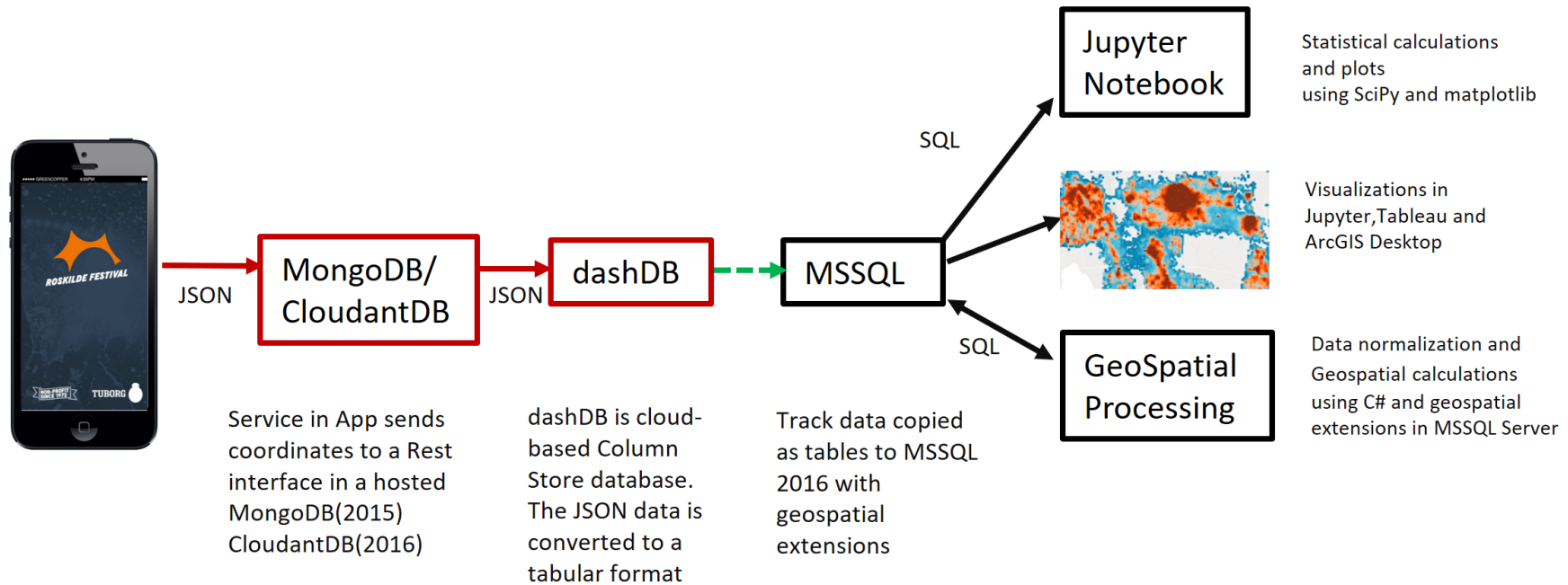




Rene Madsen  
Research Assistant

# Visual Analytics: Roskilde Festival 2015-17: Human Activities

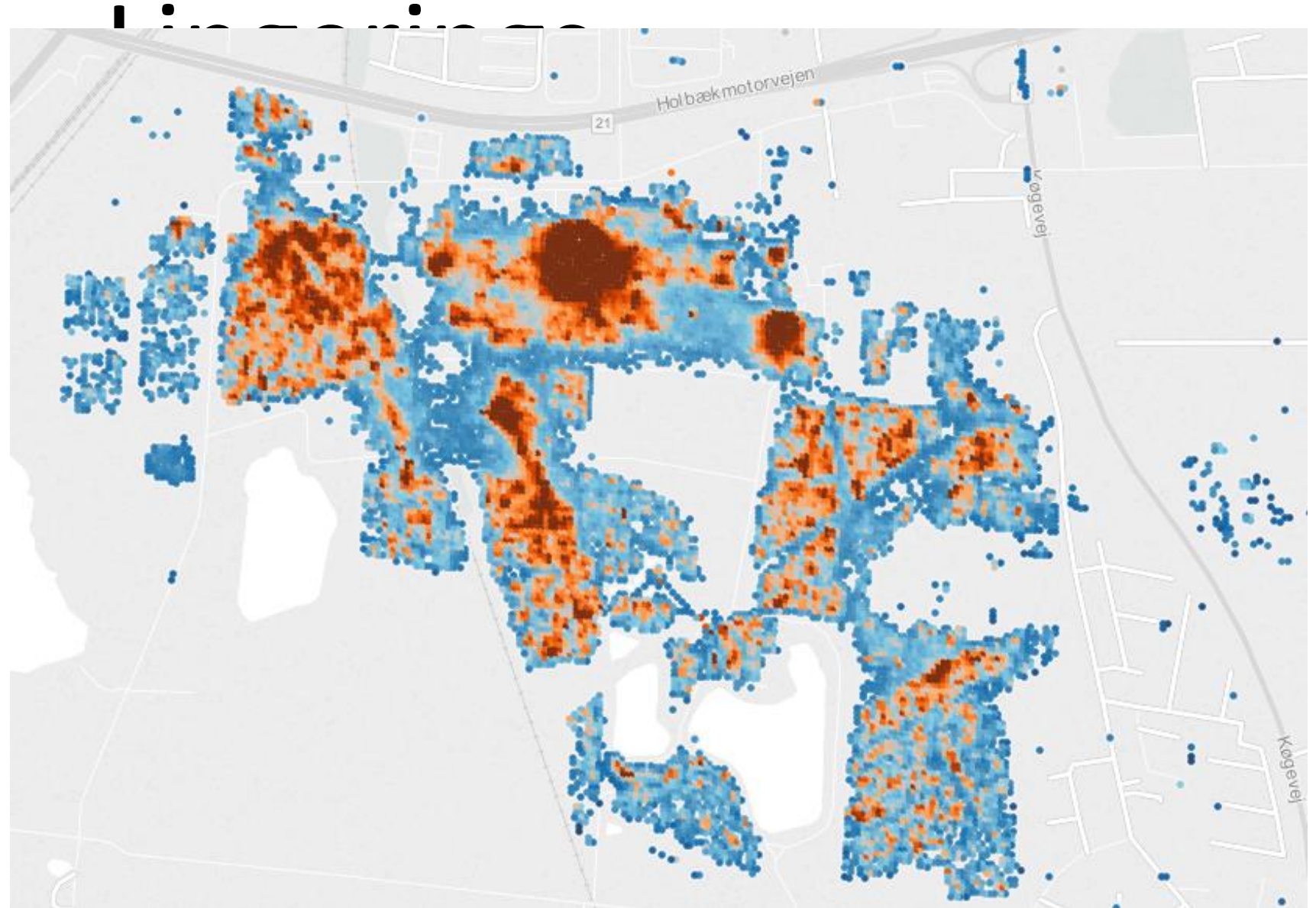
Industry Contributors:  
Henrik Hammer, Soren Ravn, & Jerome Chailloux, IBM



## RF 15: Linger

**A linger event**  
(greater than 5 minutes)

- unique user
- five observations
- within a space-time box (10x10 meters)
- aggregated to 5 minute intervals

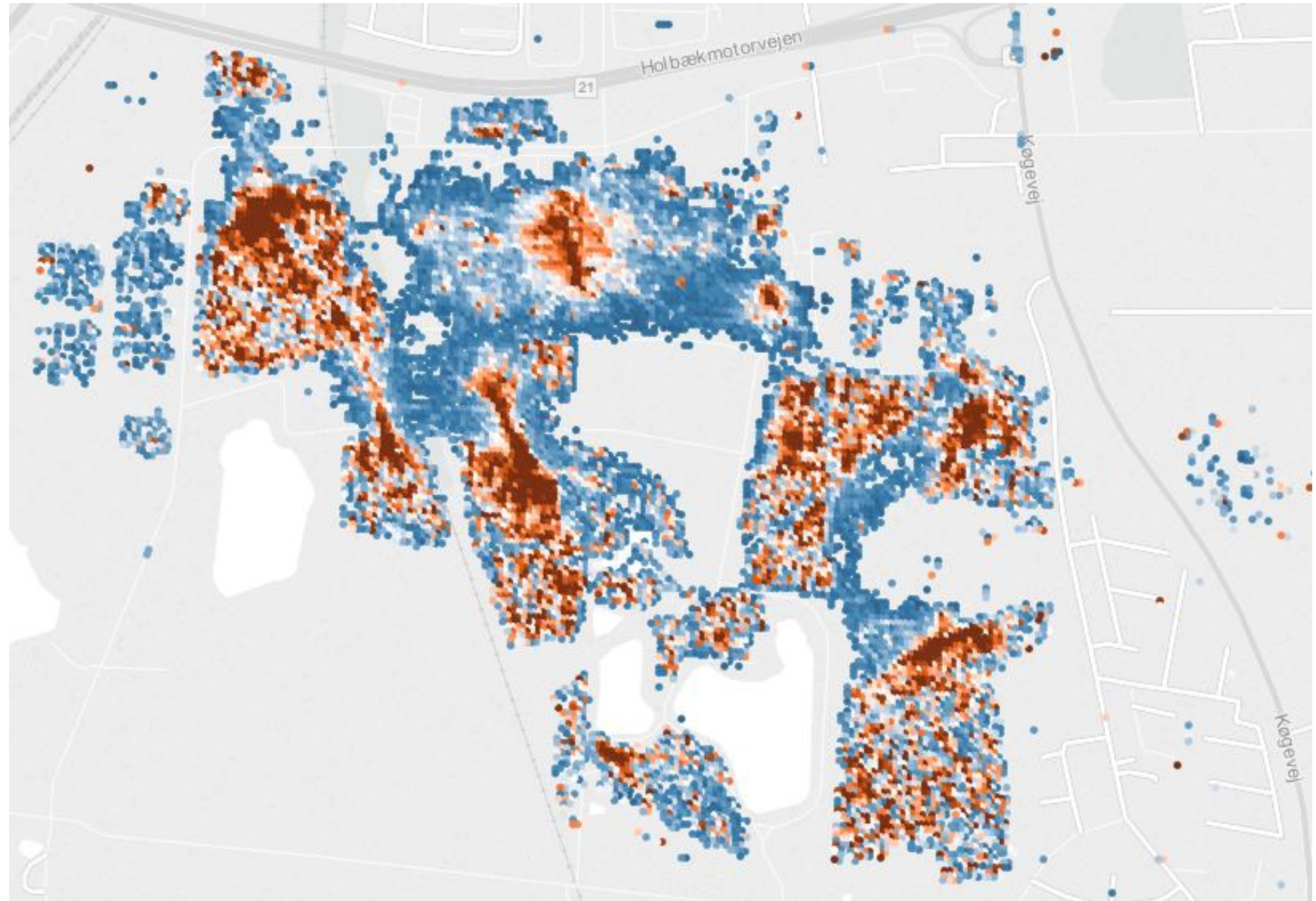


➤ **Lingerings** are illustrated as most intensely concentrated in camping and concert areas.

## RF 15: Stay

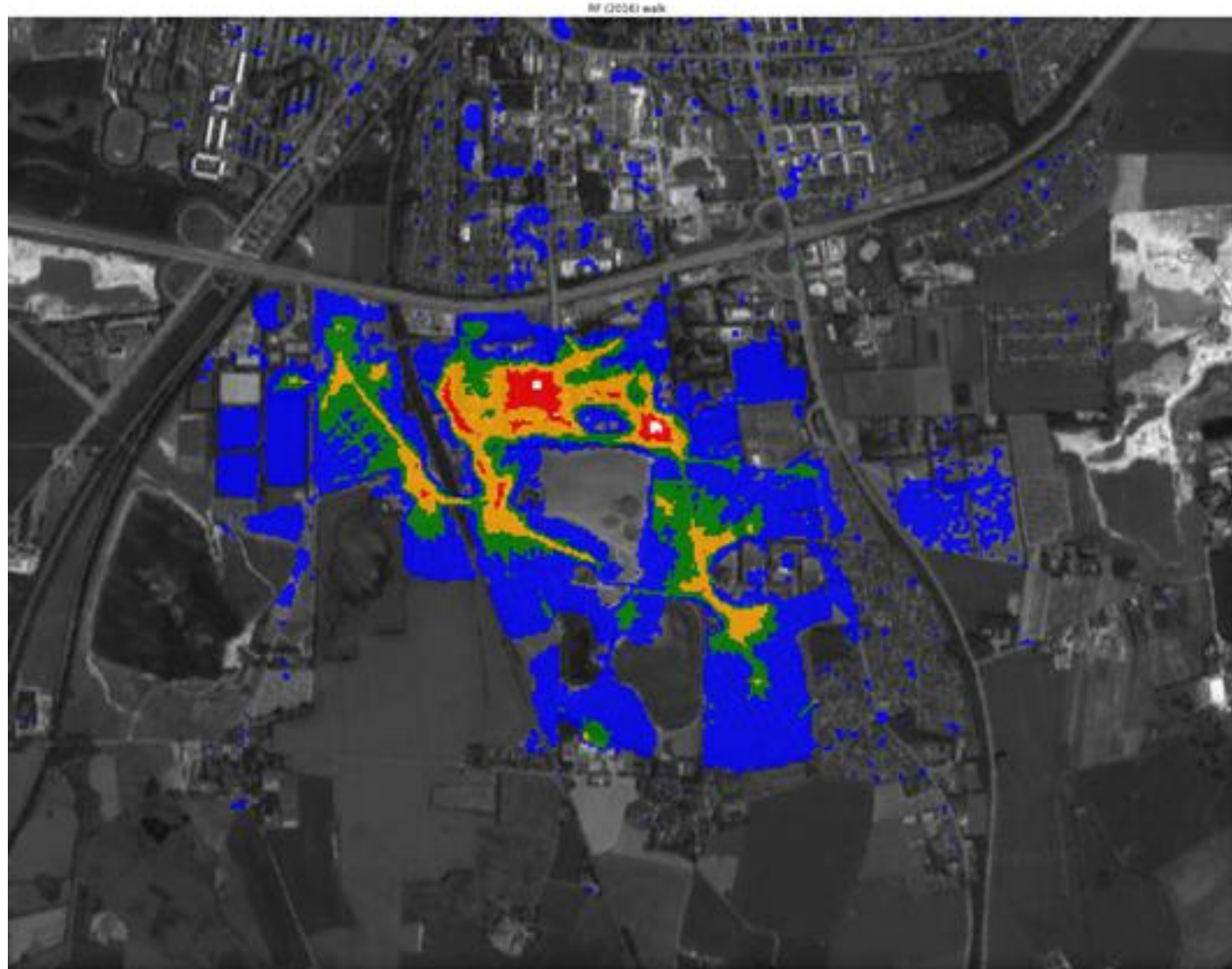
A 'stay' event  
(greater than 15 minutes)

- unique user
- 15 observations
- within a space-time box
- aggregated to 15 min intervals
- *and only if present within the same for all 15 mins*



➤ discover unexpected places where people serendipitously spend time.

# RF 16: Activity: Heat Map: Walking



# RF 16: Activity: Heat Map: Linger



Green is where stay, linger is dominant (>60%)

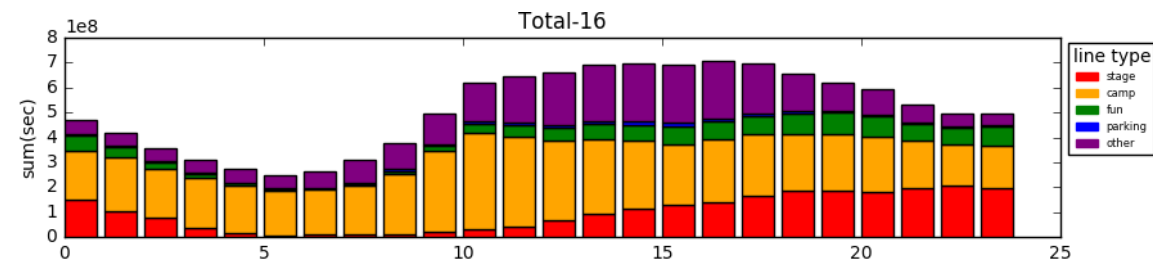
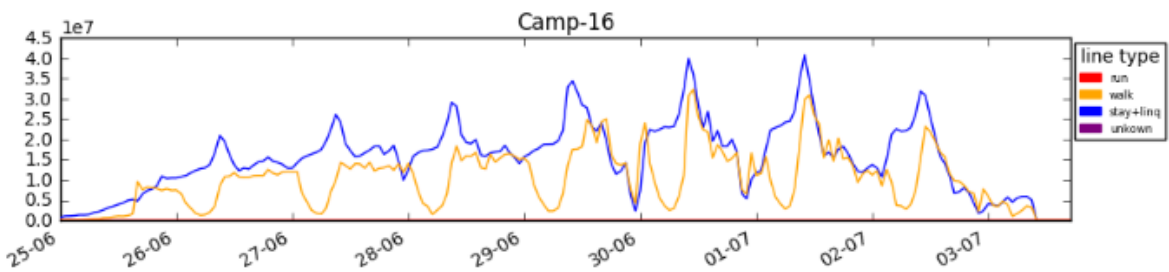
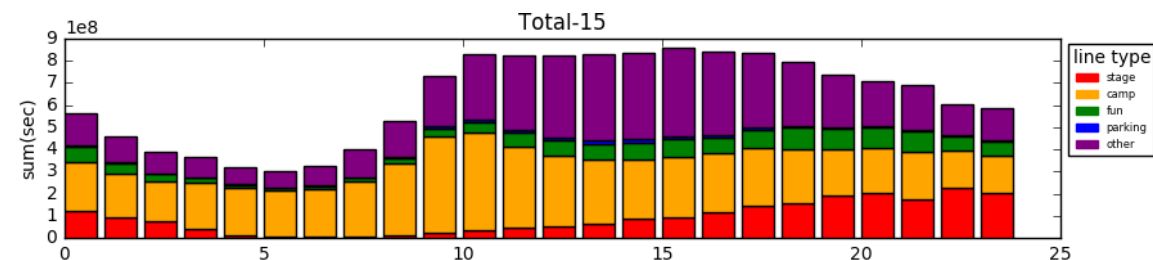
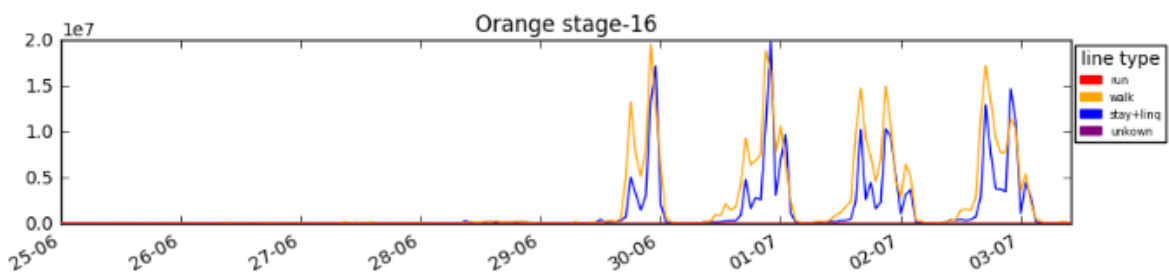
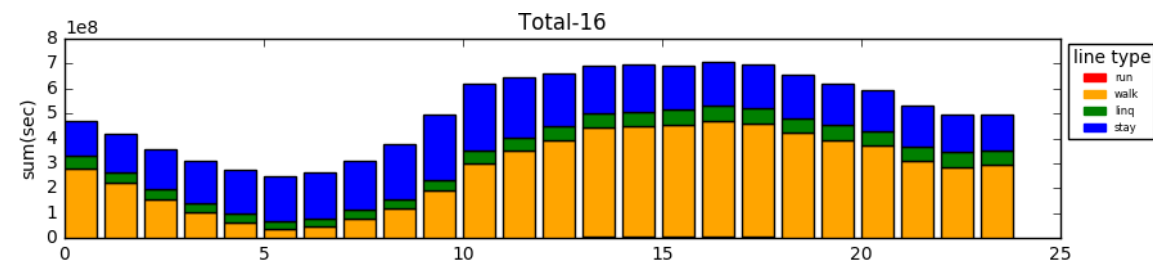
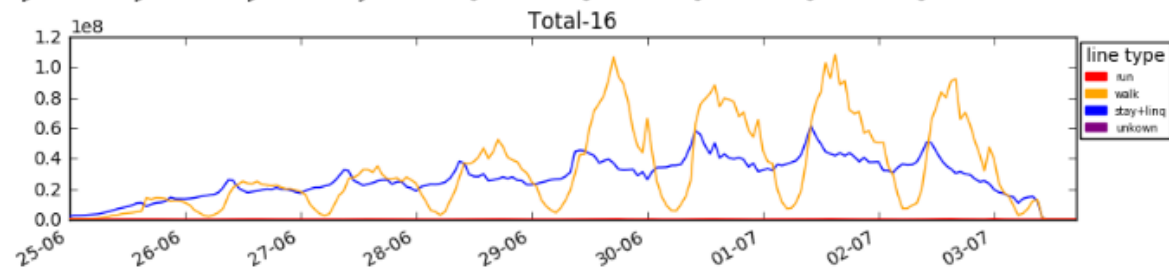
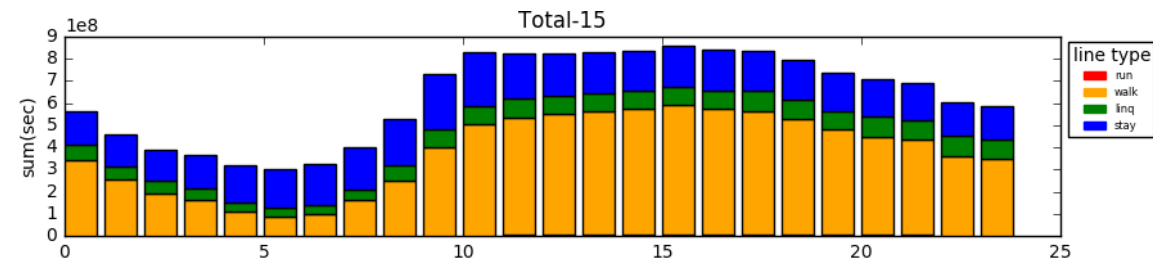
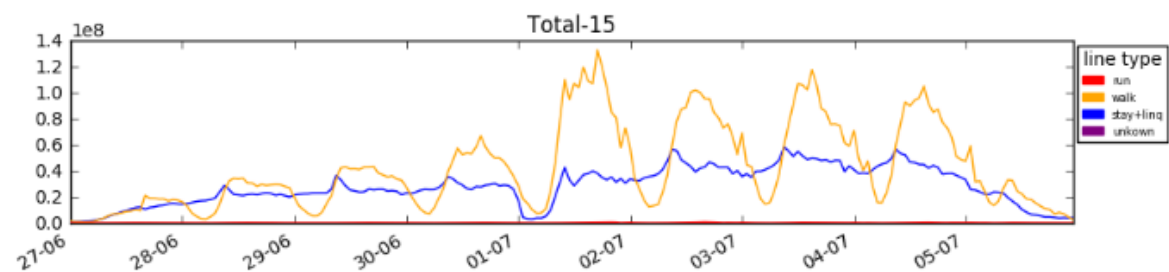
Red is where walk, run is dominant (>60%), Red areas are mostly "road/path" areas

Blue is mixed ( 40-60%)

# RF 16: Activity: Heat Map: Staying



# RF 16: Activity Type and Area Class by Time and Hour



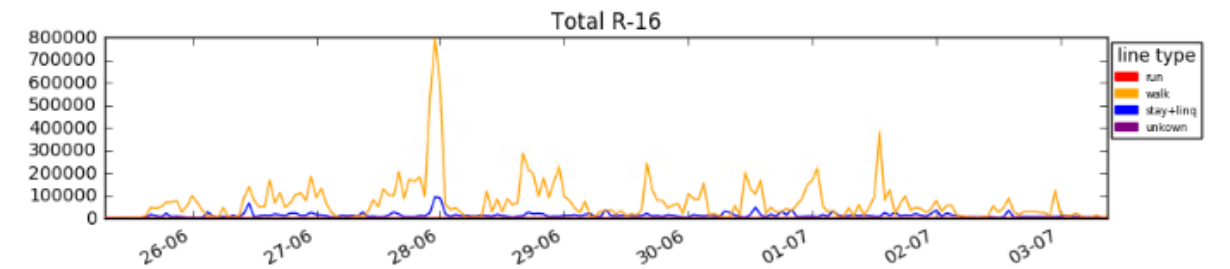
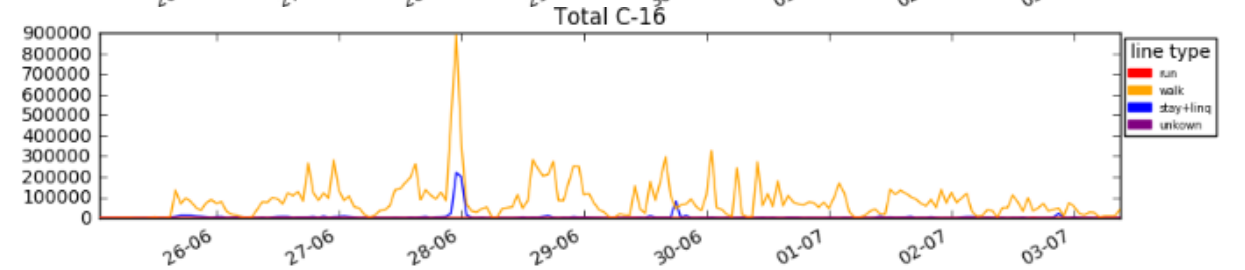
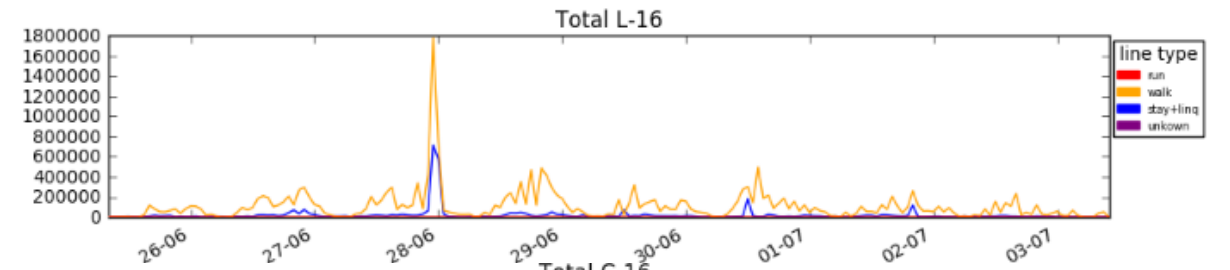
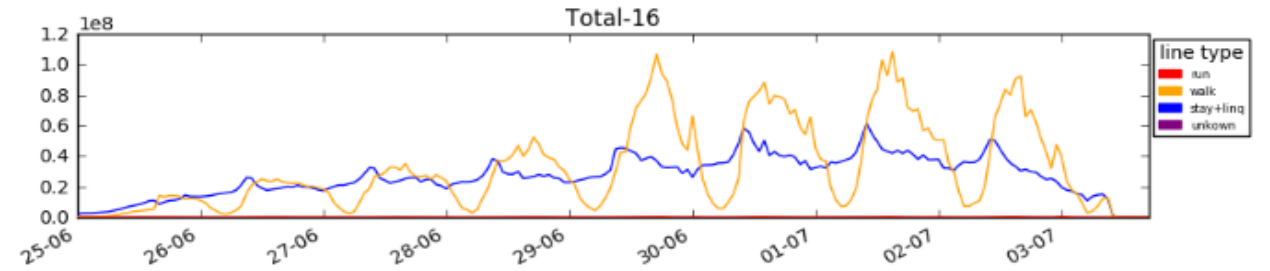
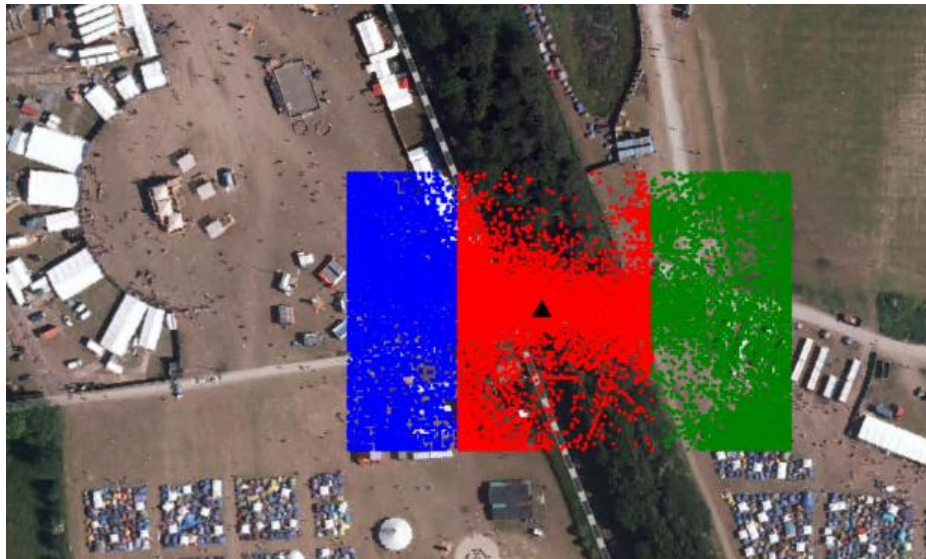
# RF: Activity: Heat Maps: Comparison: 2015 vs. 2016 vs. 2017



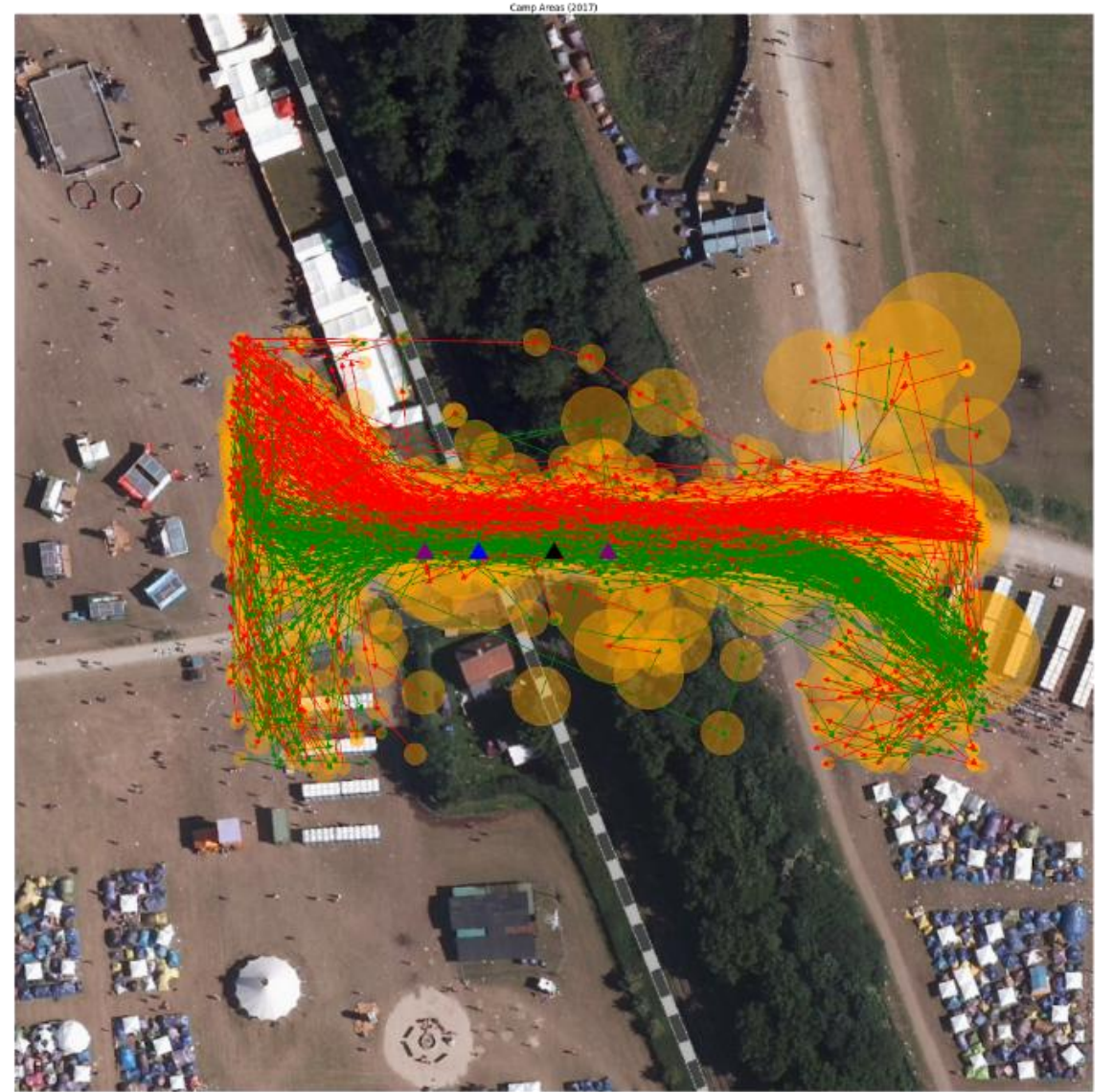
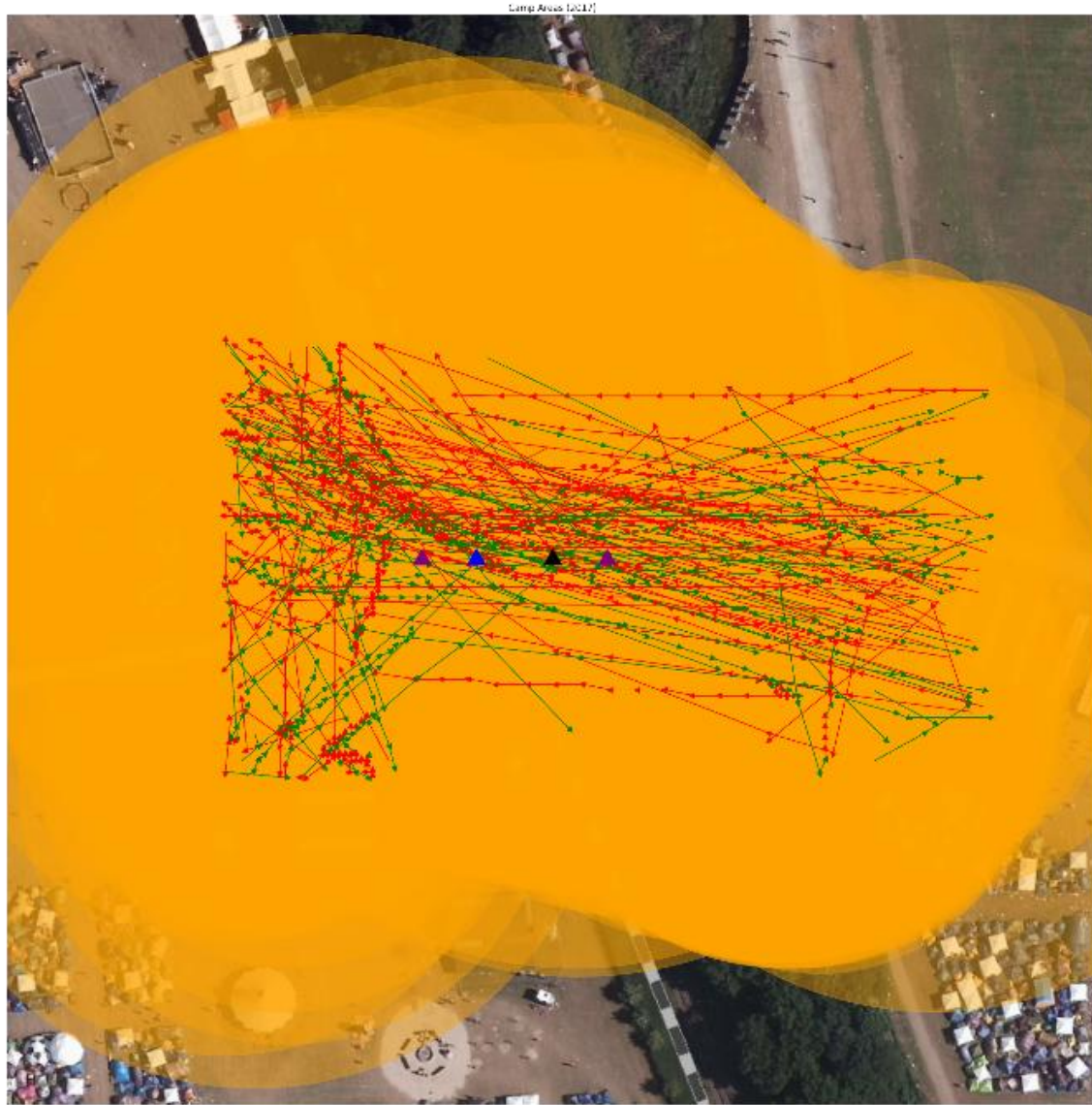
# RF 16: The Bridge Incident



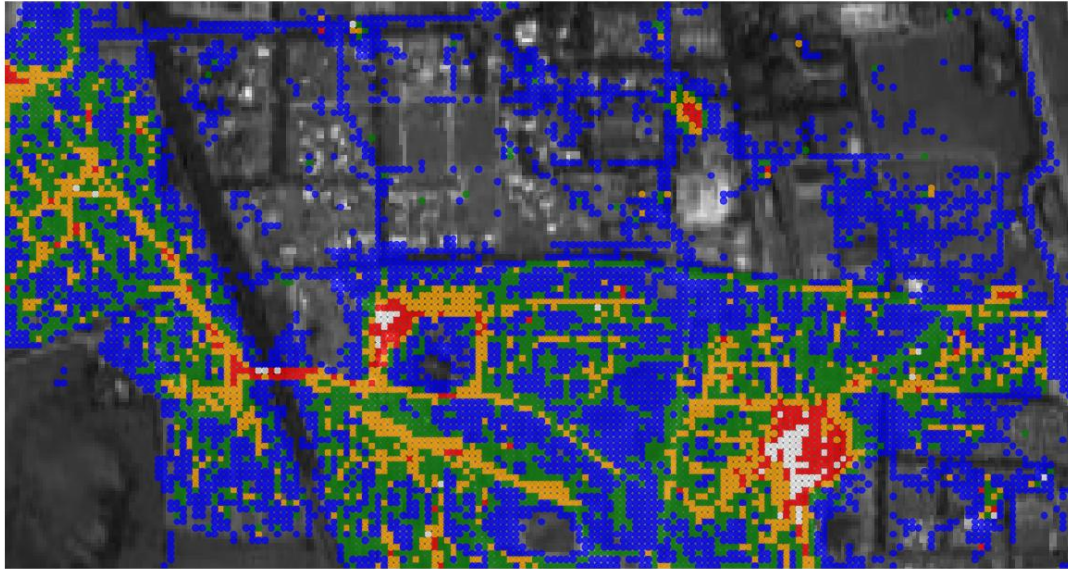
BoundBoxes Left,Center and Right of Bridge



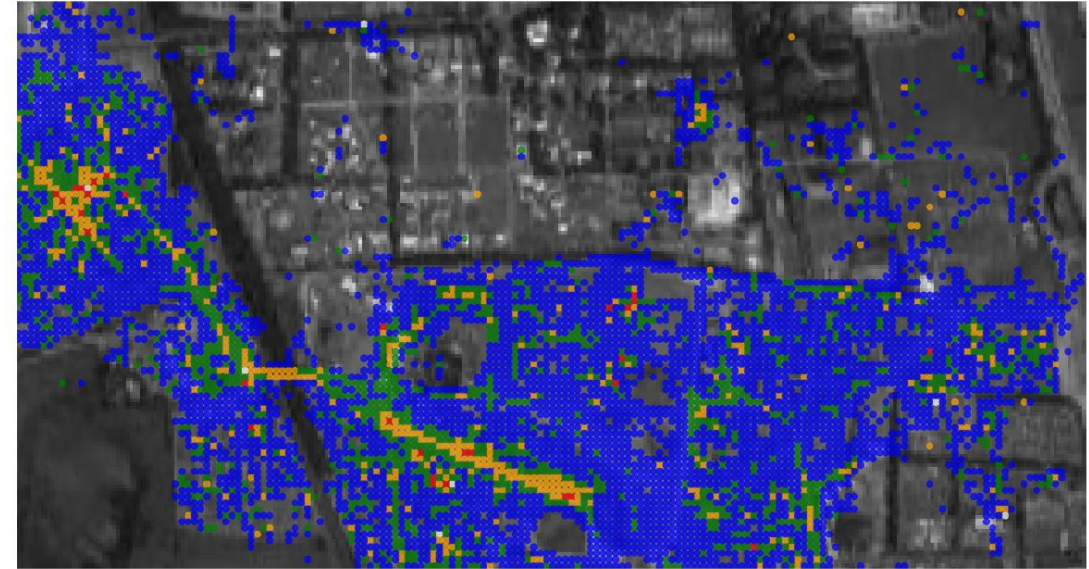
# RF: Bridge Trajectories: 2016 vs. 2017



# RF18: Geospatial Analysis: Heat Maps



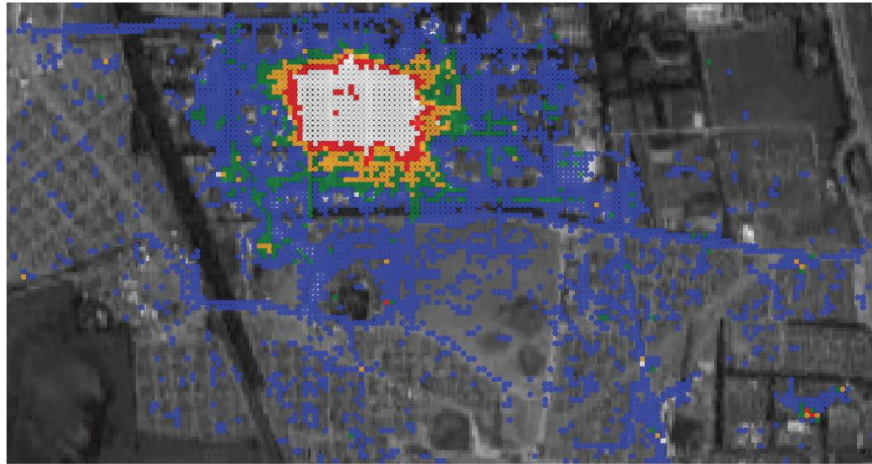
**(a) During world cup soccer match Denmark vs. Croatia on July 1st 2018 from 19:30-23:00 local time**



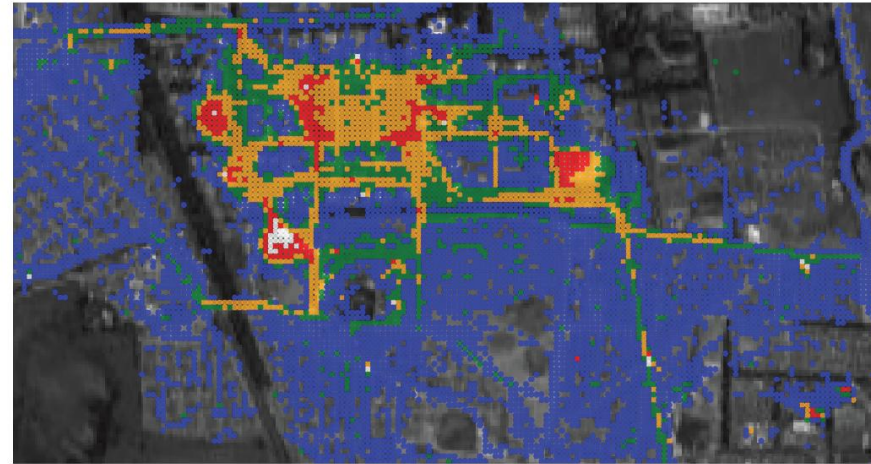
**(b) After conclusion of the soccer match with a win for Croatia after penalty shootout on July 1st 2018 from 23:00-2:00 local time**

**Figure 3. Heat maps of festival crowd density during and after Denmark vs. Croatia world cup soccer match**

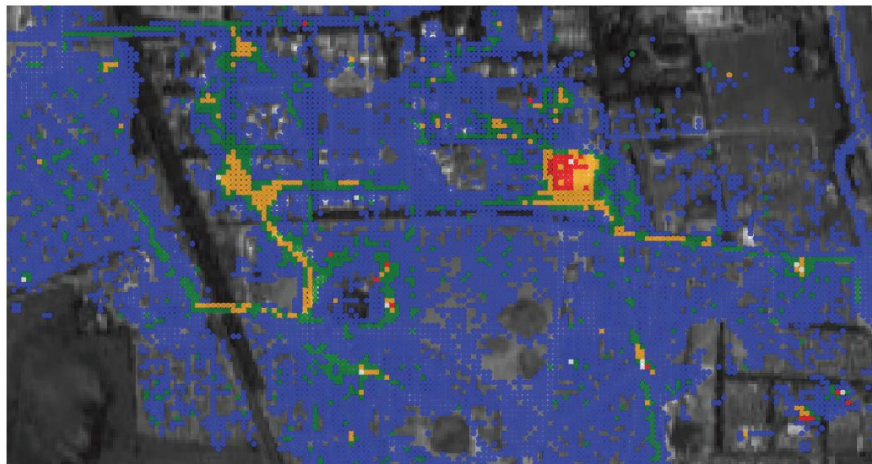
# RF18: Geospatial Analysis: Heat Maps



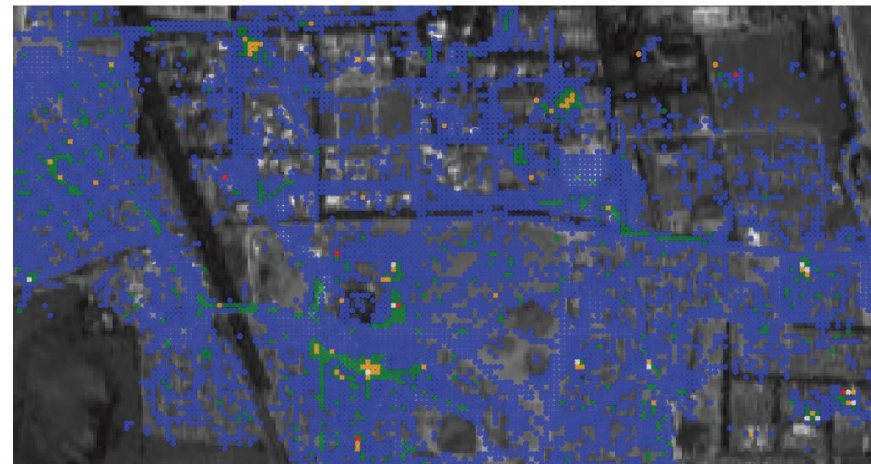
**(a) July 4th from 22:00-23:00 local time**



**(b) July 4th from 23:00-24:00 local time**

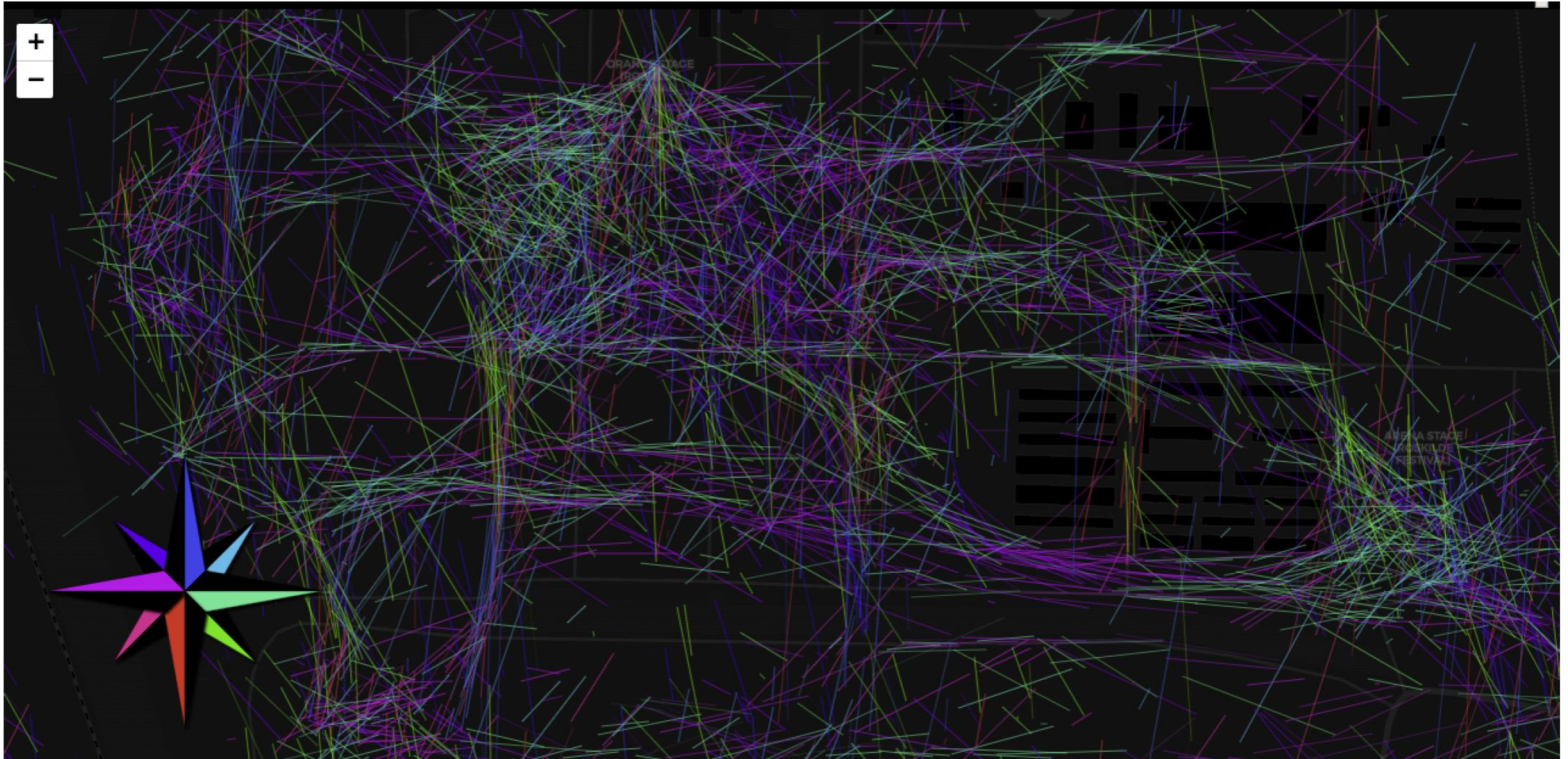


**(c) July 4th from 24:00-1:00 local time**



**(d) July 5th from 1:00-2:00 local time**

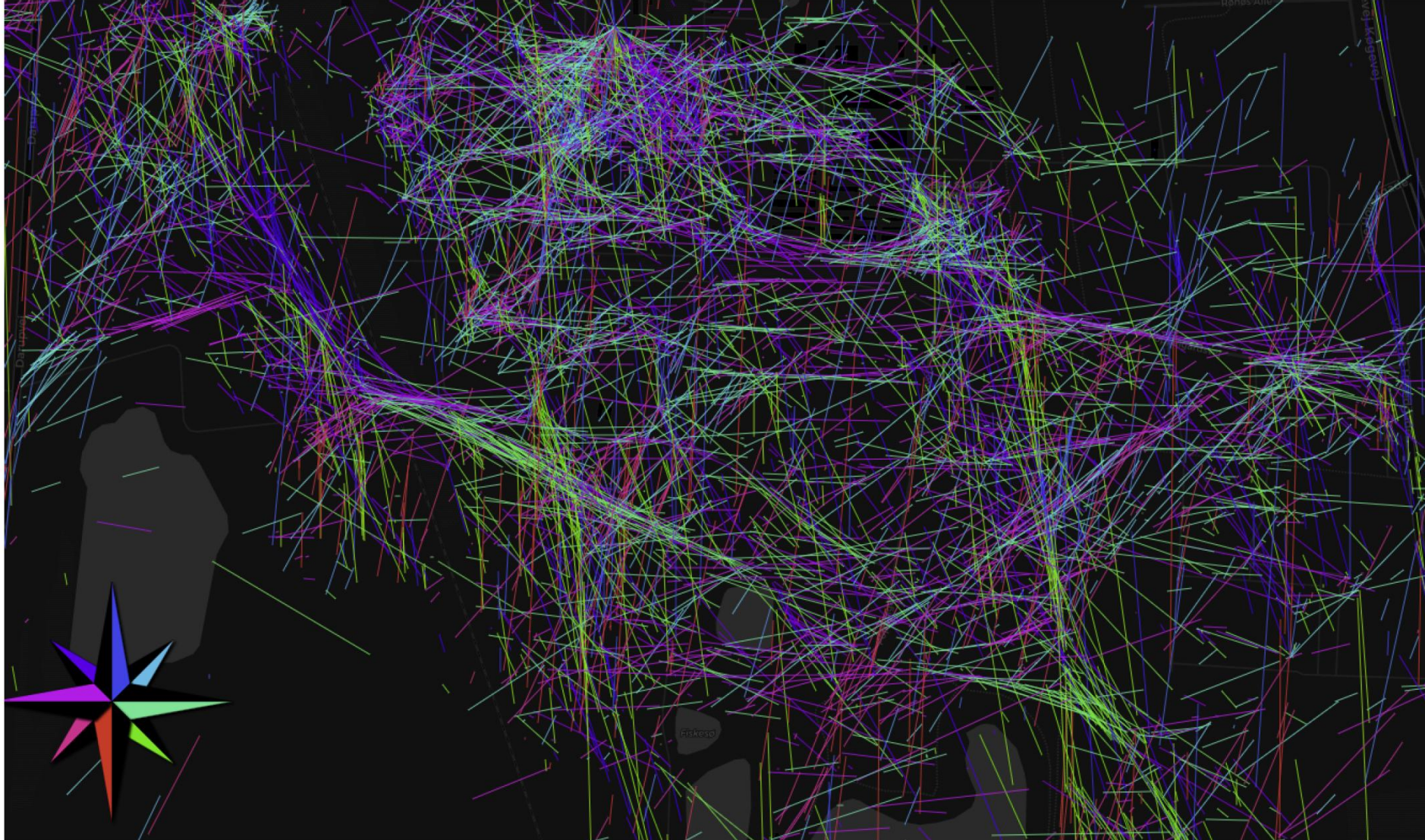
**Figure 4. Crowd density heatmaps during and after EMINEM concert**



**Figure 5. Real-time visualization of crowd trajectory at Roskilde festival 2018. Direction is color coded according to the wind rose. Old crowd movements fade out.**



## RF18: Geospatial Analysis: Dashboard: Real-Time Crowd Trajectory Visualization



**Figure 7. Real-time visualization of crowd trajectory during the final weekend of the festival.**



# Discussion

