

# Inner vs. Inter City Transmission in the Hadith Social Network

Danny Halawi<sup>\*1</sup> and Mairaj Syed<sup>†2</sup>

<sup>1</sup>Department of Computer Science, University of California, Berkeley

<sup>2</sup>Department of Religious Studies, University of California, Davis

---

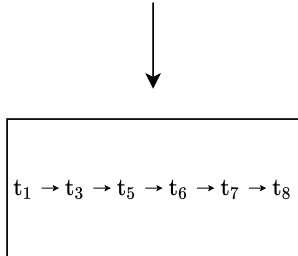
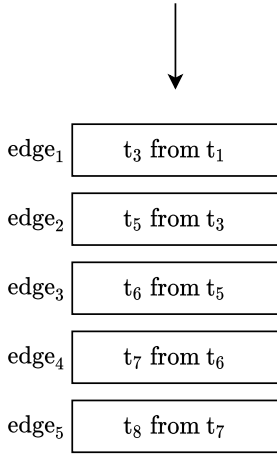
<sup>\*</sup>dannyhalawi15@gmail.com

<sup>†</sup>msyed@ucdavis.edu

# 1 Hadith to Edges

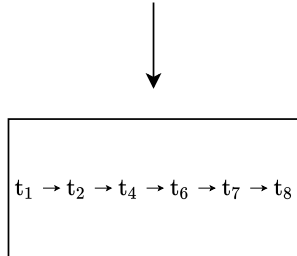
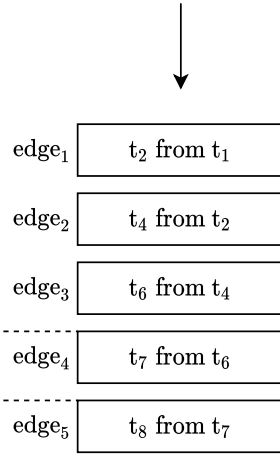
## Hadith – 1

Bukhārī (id:  $t_8$ ) writes: ‘Ubaydallāh b. Musā (id:  $t_7$ ) narrated to us, saying: Hanzala b. Abī Sufyān (id:  $t_6$ ) reported to us about ‘Ikrima b. Khālid (id:  $t_5$ ): about Ibn ‘Umar (id:  $t_3$ ), may God be pleased with them both, that he said that the Prophet (id:  $t_1$ ), peace and blessings be upon him, said: “Islam is built on five things: testifying that there is no god but God and that Muhammad is the messenger of God, establishing daily prayer, giving the charity tax, the pilgrimage, and fasting in Ramaḍān.”



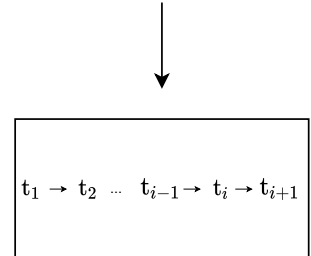
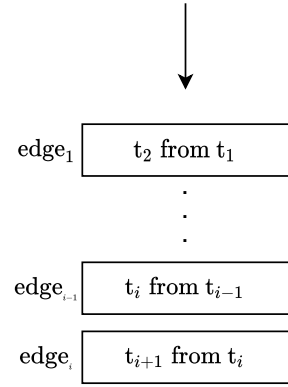
## Hadith – 2

Bukhārī (id:  $t_8$ ) writes: Ubaydallāh b. Musā (id:  $t_7$ ) narrated to us, saying: Hanzala b. Abī Sufyān (id:  $t_6$ ) reported to us about al-Qāsim b. Muḥammad (id:  $t_4$ ) about ‘Ā’isha (id:  $t_2$ ), may God be pleased with her, that she said: “the Prophet (id:  $t_1$ ), peace and blessings be upon him, used to pray thirteen cycles during the night, including the witr and dawn prayers.”

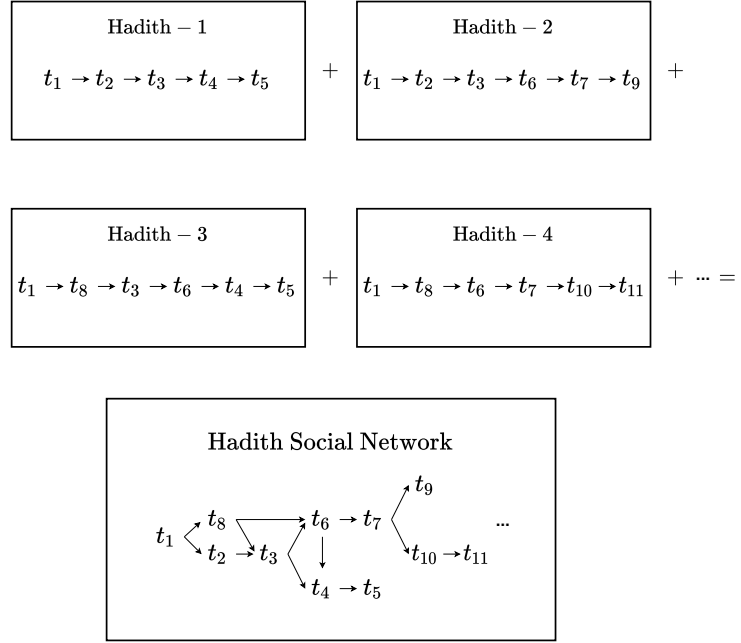


## Hadith – $\alpha$

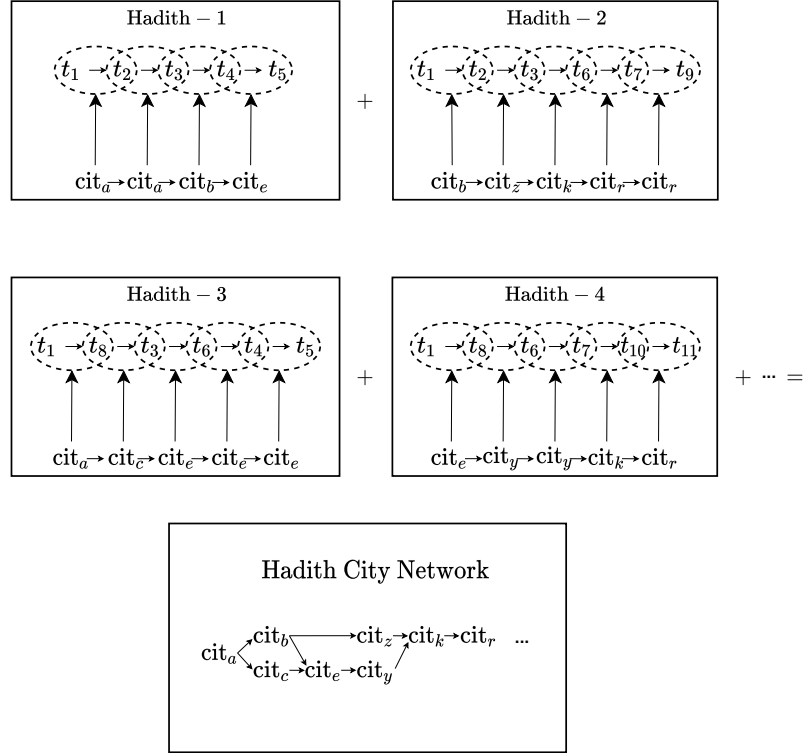
[final transmitter (id:  $t_{i+1}$ )] [mode of transmission] [intermediary transmitter (id:  $t_i$ )] [mode of transmission] [intermediary transmitter (id:  $t_{i-1}$ )] ... [intermediary transmitter (id:  $t_2$ )] [mode of transmission] [initial transmitter (id:  $t_1$ )] [matn (content)]



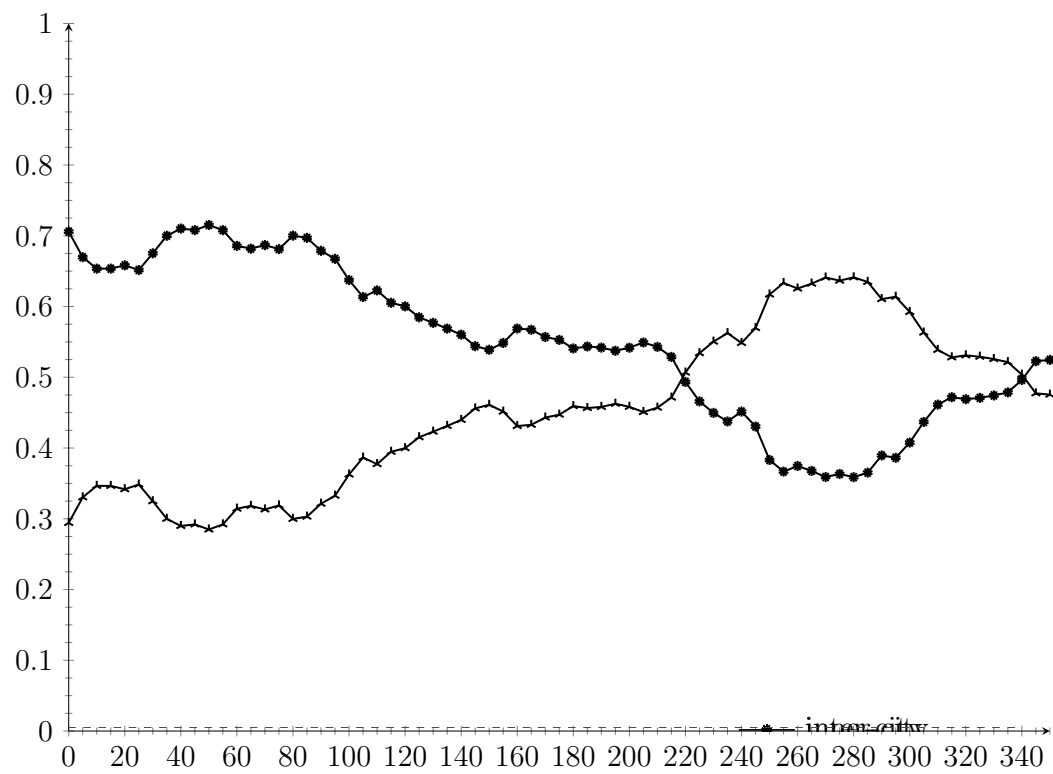
## 2 Edges to HSN



### 3 Edges to City Network



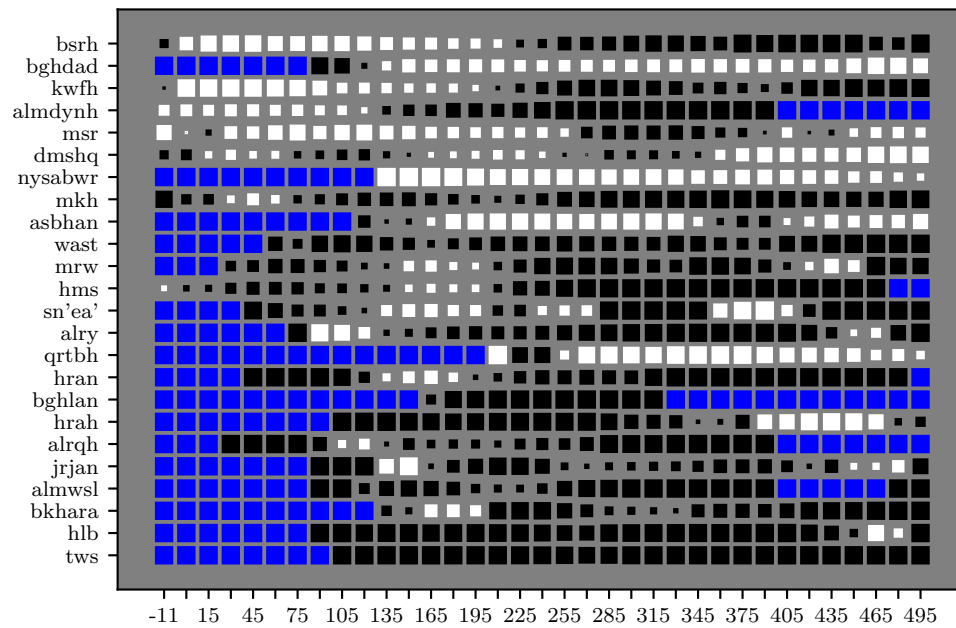
## 4 Bird's-eye View First 400 Years



## 5 Bird's-eye View First 630 Years



## 6 City Analysis



## 7 Transmitter Analysis (Inner)

year span		transmitter	inner	inter	ratio	transmitter	inner	inter	ratio
-11	0	4049	2543	1	0.9996	3436	8849	4573	0.6593
0	15	4945	260	2	0.9924	4945	260	2	0.9924
15	30	5913	913	2	0.9978	5913	913	2	0.9978
30	45	5543	246	2	0.9919	5722	1021	777	0.568
45	60	4049	2543	1	0.9996	4396	5949	5	0.9992
60	75	4980	770	1	0.9987	4967	3665	728	0.8342
75	90	2069	2817	5	0.9979	2069	2817	5	0.9979
90	105	5739	659	5	0.9922	4903	1838	22	0.9877
105	120	7863	3500	17	0.9949	6458	3500	834	0.8075
120	135	6399	145	1	0.9932	7272	4993	3160	0.6124
135	150	6712	396	3	0.9925	3629	6202	1720	0.7828
150	165	7133	278	1	0.9929	3436	8849	4573	0.6593
165	180	6437	288	3	0.9877	2492	8146	2338	0.777
180	195	4553	578	2	0.9953	6904	3376	67	0.9803
195	210	4244	295	1	0.9966	8160	6936	2066	0.7705
210	225	5938	360	1	0.9953	4533	6210	5175	0.5454
225	240	5435	594	1	0.9983	5049	6627	9838	0.4025
240	255	5219	129	1	0.9923	6879	6411	129	0.9802
255	270	12613	631	1	0.9968	8613	2244	125	0.947
270	285	17654	119	1	0.9905	12383	1437	430	0.7697
285	300	34407	105	1	0.9906	11603	1773	1421	0.5551
300	315	11548	231	1	0.9957	10025	2964	8106	0.2678
315	330	10596	476	1	0.9979	23051	2507	641	0.7962
330	345	10437	182	3	0.9837	27677	648	38	0.9435
345	360	22973	154	1	0.9918	28131	1515	24	0.9843
360	375	26320	547	2	0.9959	8994	3976	40	0.9899
375	390	22975	574	2	0.9955	24549	801	612	0.5668
390	405	18175	529	1	0.9977	26123	781	9	0.9884
405	420	41612	81	1	0.9878	13204	806	12	0.985
420	435	46431	91	1	0.9892	14773	744	51	0.9354
435	450	29523	148	1	0.9933	28387	207	11	0.9488
450	465	10610	210	1	0.995	29539	494	5	0.9898
465	480	46135	351	1	0.9972	21277	908	250	0.784
480	495	9601	312	3	0.9904	24779	528	38	0.9329
495	510	46384	95	1	0.9896	27317	325	10	0.9687



## 8 Transmitter Analysis (Inter)

year span		transmitter	inner	inter	ratio	transmitter	inner	inter	ratio
-11	0	30371	1	768	0.9987	3795	6140	13990	0.695
0	15	6618	1	3	0.75	6618	1	3	0.75
15	30	322	1	27	0.9643	7547	109	179	0.6212
30	45	3476	1	184	0.9946	5079	122	1750	0.9344
45	60	5672	1	304	0.9967	5021	2	485	0.9949
60	75	6259	1	81	0.9878	4883	2749	2806	0.5051
75	90	4622	1	127	0.9922	3929	14	780	0.9824
90	105	720	6	220	0.9692	2840	562	606	0.5186
105	120	4002	4	276	0.9858	5625	1261	1065	0.4579
120	135	4612	1	141	0.993	7272	4993	3160	0.3876
135	150	2622	1	123	0.992	3629	6202	1720	0.2172
150	165	8621	1	100	0.9902	3795	6140	13990	0.695
165	180	2201	1	165	0.994	2492	8146	2338	0.223
180	195	2450	1	127	0.9922	4716	189	3086	0.9421
195	210	3741	3	574	0.9944	3443	4433	13741	0.7561
210	225	1326	1	172	0.9942	4533	6210	5175	0.4546
225	240	3840	1	478	0.9979	5049	6627	9838	0.5975
240	255	5390	1	353	0.9972	488	3995	12611	0.7594
255	270	448	1	250	0.996	6817	663	3268	0.8313
270	285	30371	1	768	0.9987	28612	260	1415	0.8444
285	300	9844	1	419	0.9976	24433	29	3375	0.9914
300	315	25528	1	365	0.9973	10025	2964	8106	0.7322
315	330	9869	1	113	0.9912	22334	55	791	0.9345
330	345	30623	1	222	0.9955	10289	102	1213	0.9223
345	360	9866	1	712	0.9986	31063	422	3391	0.8891
360	375	28652	1	29	0.9673	22989	947	1387	0.594
375	390	17165	3	84	0.9643	28230	191	1492	0.8861
390	405	16463	3	303	0.9897	28679	83	527	0.8638
405	420	27629	6	748	0.9908	27629	6	748	0.9908
420	435	41400	1	90	0.9891	9927	147	952	0.8658
435	450	14991	1	309	0.9968	14991	1	309	0.9968
450	465	11867	1	322	0.9969	10034	489	543	0.5261
465	480	62375	1	176	0.9944	21277	908	250	0.216
480	495	46105	1	22	0.9578	18850	25	67	0.7287
495	510	63281	1	5	0.8453	27317	325	10	0.03131