

Curriculum Vitae  
**Bilal Khan**  
grouptheory@gmail.com  
<http://transdiscipline.com>

## RESEARCH INTERESTS

Transdisciplinary applications of **network science**, including:

1. *Network and computational social science*; to develop new statistical methods, modeling/simulation techniques, and data collection technologies, towards a clearer understanding of important sociological phenomena, particularly as related to public health.
2. *Social organization of wireless digital devices within the "Internet of Things"*; to leverage existing knowledge about resource sharing in human societies to better predict and direct the evolutionary trajectory of behaviors and social organization manifested within wireless device societies in a resource-limited radio frequency ecosystem.
3. *Emergence of social organization within complex adaptive systems*; to develop formal models of social behaviors from mathematical "first principles", and show through simulation experiments and mathematical argument, that many of the macroscopic features observed in human collectives are theoretically inevitable when such formal complex adaptive dynamical systems are subject to long term evolutionary pressures.
4. *Co-evolution of computer malware and operating systems*, and its implications for future digital security.

## EDUCATION

**Ph.D. Mathematics**, CUNY Graduate Center, 2003.

Advisor: Alexei Miasnikov,

*Algorithmic problems on automorphic conjugacy in the free group of rank 2.*

**M.Sc. Computer Science**, Johns Hopkins University, 1997.

Advisor: Baruch Awerbuch

*New algorithms for topology aggregation and competitive on-line routing.*

**B. Sc. Math & Computer Science**, Massachusetts Institute of Technology, 1993.

## EMPLOYMENT

University of Nebraska-Lincoln  
**Happold Professor of Sociology** 2016 - Present

John Jay College, CUNY  
**Professor of Mathematics and Computer Science** Sep. 2009 - Dec. 2015  
Associate Professor of Mathematics and Computer Science Sep. 2004 - Aug. 2009

CUNY Graduate Center  
**Doctoral Faculty in Criminal Justice** Jan. 2008 - Present

Affiliate, **Center for Drug Use & HIV Research** (NYU) Aug. 2011 - Present  
Affiliate, **Center for Court Innovation** (NYC) Oct. 2009 - Mar. 2012  
Affiliate, **Urban Institute** (DC) Jan. 2011 - Jan. 2013

**Co-Director, Social Networks Research Group** Jan. 2009 - Present  
[www.snrq-nyc.org](http://www.snrq-nyc.org)

**Center for Computational Science, U.S. Naval Research Lab** (DC)  
Lead Scientist, Networking Group Oct. 2000 - Sep. 2004  
Research Scientist Jan. 1996 - Sep. 2000

Director of Research Lab for Digital Forensics & Cybersecurity Sep. 2004 - Present  
John Jay College

Memberships: IEEE, ACM, AMS, SIAM

## FUNDED RESEARCH PROJECTS CURRENTLY IN PROGRESS

May 2016-April 2019 **Principal Investigator** (with co-PI K Dombrowski)  
“Modeling Social Behavior via Dynamic Network Interaction” National Institute of Health, General Medical Sciences (\$1,256,126) R01 GM118427.

September 2014-August 2017 **Principal Investigator** (with co-PI K Dombrowski)  
“Applying Behavioral-Ecological Network Models to Enhance Distributed Spectrum Access in Cognitive Radio” (\$499,986) National Science Foundation AST 1443985.

August 2014-July 2019 **Principal Investigator** (with co-PI K Dombrowski and J.C. Reyes)  
“Injection Risk Networks in Rural Puerto Rico” (\$2,892,980) National Institute of Health / National Institute of Drug Abuse R01DA037117.

July 2013-June 2017 **co-Investigator** (PI H Hagan, New York University, co-I K Dombrowski)  
“Addressing HCV-related hepatocellular carcinoma: the current and future epidemics” (\$2,840,000) National Institute of Drug Abuse, R01 DA034637.

## FUNDED RESEARCH PROJECTS COMPLETED

- A. Principal Investigator Sept. 2014-Feb. 2016  
“Towards a cellphone-based infrastructure for harvesting dynamic interaction data”  
(\$249,780) **NSF**, Social Behavioral and Economic Sciences
- B. co-PI (with Meredith Dank), Jan. 2011-Jan. 2013  
“Estimating the Unlawful Commercial Sex Economy in the United States”  
(\$499,036). **National Institute of Justice**.
- C. R01 co-PI Investigator (Dombrowski PI), Oct. 2009-Nov. 2011.  
“Injection Drug User Network Topologies and HIV Stabilization Dynamics”  
(\$736,858) **National Institute of Health**, National Institute of Drug Abuse.
- D. Methodologist (Michael Rempel, PI) Oct. 2009-Mar. 2012  
“Commercial Sexual Exploitation of Children in the US”  
(\$1,275,000). **Department of Justice**, Office of Justice Programs.
- E. Co-I (with Dombrowski) Jun. 2009-Jun. 2012.  
“Informal Social Networks in Two Labrador Communities” (\$562,000).  
**National Science Foundation**, Division of Arctic Social Sciences.
- F. Co-I (with Dombrowski) Sept. 2008- May 2009. “Network Topological Factors  
Affecting Long-term Stabilization of HIV Rates Among Injecting Drug Users”  
(\$40,600). **National Science Foundation**, Anthropology Program.
- G. Principal Investigator Sept. 2007- May 2008.  
“Information Acquisition and Delivery for Disaster Recovery Teams”. (\$74,000).  
**National Security Agency**, Network Sciences Program.
- H. Methodologist (Travis Wendel, PI) June 2007-June 2009.  
“Retail Methamphetamine Markets in New York City” (\$474,000)  
**National Institute of Justice / National Institute of Health** (jointly funded).
- I. Principal Investigator. Sept. 2005 – May 2007.  
“Computational Aspects of Algebraic Geometry over Groups”. (\$30,000) **National  
Security Agency**, Mathematical Sciences Program.
- J. Methodologist (Mike Rempel PI) Jun. 2006-Aug. 2007.  
“The Commercial Sexual Exploitation of Children in New York City” (\$62,000).  
**National Institute of Justice**.

## REFEREED PUBLICATIONS (BY AREA)

### *Network and Computational Social Science*

1. Kirk Dombrowski, Patrick Habecker, G. Robin Gauthier, Joshua Moses, and Bilal Khan, "Relocation Redux: Labrador Inuit population movements and inequalities in the land claims era", *Current Anthropology* 57(6): 785-805, 2016.
2. Kirk Dombrowski, Bilal Khan, Patrick Habecker, Holly Hagan, Samuel R. Friedman, Mohammed Saad "The Interaction of Human Social Systems and Virus Natural History in the non-Spreading of HIV." *AIDS and Behavior* (First Online: DOI: 10.1007/s10461-016-1568-6), 2016.
3. Kirk Dombrowski, Kelley Sittner, Devan Crawford, Melissa Welch-Lazoritz, Patrick Habecker, Bilal Khan, "Network approaches to substance use and HIV/hepatitis C risk among homeless youth and adult women in the United States: A Review." *Health* (Irvine, CA), invited special issue: *Substance Abuse and Related Disorders*, 8(3): 1143-1165, 2016.
4. Bilal Khan, Mitchell Downey, Meredith Dank, Kirk Dombrowski. "A method for determining the size of the underground cash economy for commercial sex in seven US cities," In S. Cunningham and M. Shah (eds) *Oxford Handbook of the Economics of Prostitution*, pp. 348-68. Oxford University Press, 2016.
5. Kirk Dombrowski, Devan Crawford, Bilal Khan, Kimberly Tyler, "Current Rural Drug Use in the US Midwest" *Journal of Drug Abuse* 2(3:22): 1-8, 2016.
6. Patrick Habecker, Kirk Dombrowski, and Bilal Khan "Improving the Network Scale-Up Estimator: Incorporating Means of Sums, Recursive Back Estimation, and Sampling Weights." *PLoSOne* 10(12): e0143406, 2015.
7. Bilal Khan, Kirk Dombrowski, Ric Curtis and Travis Wendel, "Estimating Vertex Measures in Social Networks by Sampling Completions of RDS Trees." *Social Networking* 4(1):1-16, 2015.
8. H. Hagan, J. Nuerer, A. E. Jordan, D. C. Des Jarlais, J. Wu, K. Dombrowski, B. Khan, S. Braithwaite, J. Kessler. "Hepatitis C. Virus Incidence among HIV+ Men Who Have Sex with Men: The Role of Non-Injection Drug Use." *Drug and Alcohol Dependence* 146: e118-e201, 2015
9. Kirk Dombrowski, Bilal Khan, Joshua Moses, Emily Channell, and Ric Curtis, "Sampling Social Divisions in a Rural Inuit Community." *Identities* 21 (2): 134-151, 2014.
10. Bilal Khan, Kirk Dombrowski, and Mohammad Saad, "A stochastic agent-based model of pathogen propagation in dynamic multi-relational social networks." *Simulation: Transactions of the Society for Modeling and Simulation International* 90 (4): 460-484, 2014.
11. Holly Hagan, Joshua Neuer, Ashly E Jordan, Don C Des Jarlais, Jennifer Wu, Kirk Dombrowski, Bilal Khan, R Scott Braithwaite and Jason Kessler. "Hepatitis C virus infection among HIV-positive men who have sex with men: Protocol for a systematic review and meta-analysis." *Systematic Reviews* 3 (31): 1-31, 2014.

12. Mohsen Guizani, Ammar Rayes, Bilal Khan and Ala Al-Fuqaha. Network Modeling and Simulation: A Practical Perspective, Wiley-Interscience, ISBN 978-0470035870, 2010, 304 pages.
13. Bilal Khan, Kirk Dombrowski, Mohammad Saad, Katherine McLean, and Samuel R. Friedman. Network firewall dynamics and the sub-saturation stabilization of HIV. *Discrete Dynamics in Nature and Society*, Article ID 720818, 2013, 16 pages
14. Kirk Dombrowski, Ric Curtis, Samuel R. Friedman, and Bilal Khan. Topological and Historical Considerations for Infectious Disease Transmission among Injecting Drug Users in Bushwick, Brooklyn (USA). *World Journal of AIDS*, Vol. 3(1), 2013, Pages 1-9, PMC3963185.
15. Kirk Dombrowski, B. Khan, E. Channell, J. Moses, K. McLean, N. Dombrowski. Kinship connections in a Labrador Inuit community. *Arctic Anthropology*, Vol. 50(1), UWPress, 2013, Pages 89-104.
16. Kirk Dombrowski, Bilal Khan, Joshua Moses, Emily Channell, and Evan Misshula. Assessing Respondent Driven Sampling for Network Studies in Ethnographic Contexts. *Advances in Anthropology*, Vol. 3, 2013, Pages 1-9.
17. Kirk Dombrowski, E. Channell, B. Khan, J. Moses, and E. Misshula. Out on the Land: Income, Subsistence Activities and Food Sharing Networks in Nain, Labrador. *Journal of Anthropology*, Article ID 185048, 2013, 11 pages.
18. Kirk Dombrowski, Bilal Khan, Katherine McLean, Travis Wendel, Evan Misshula, Samuel Friedman, Ric Curtis, A re-examination of connectivity trends via Exponential Random Graph modeling in two IDU risk networks. *Substance Use and Misuse*, Vol. 48(14), 2013, Pages 1485-1497.
19. Mohammad Saad and Bilal Khan, Dynamic Optimization of Caregiver Schedules based on Vital Sign Streams, *E-Health Telecommunication Systems and Networks*, Vol. (2)2, 2013, Pages 36-47.
20. Mohamed Saad, Bilal Khan, Ghassen Ben Brahim. "An Evaluation of the Risk Impact of Device Heterogeneity on Critical Care Delivery", Proceedings of 5th International Conference on Modeling Simulation and Applied Optimization, Hammamet, April 2013, Pages 1-6.
21. Alissa R. Ackerman and Bilal Khan. Assessing reporting patterns of child sexual abuse within the Catholic Church using discontinuities in model parameter timeseries. *Social Science Research*, Vol. 41(2), 2012, Pages 253-262.
22. Kirk Dombrowski, B. Khan, T. Wendel, K. McLean and R. Curtis, Estimating the Size of the Methamphetamine-Using Population in New York City Using Network Sampling Techniques. *Advances in Applied Sociology*, Vol. 2(4), 2012, Pages 245-252.
23. Carol Dottin and Bilal Khan. "Scheduling Cooperative Emergency Response (or how the Meek shall overcome the Greedy)", Proceedings of International Wireless Communications and Mobile Computing Conference International Workshop on Advanced Topics in Mobile Computing for Emergency Management, 2009, Pages 598-602.

*Social organization of wireless digital devices within the “Internet of Things”*

1. Anna Wisniewska, Bilal Khan, Ala Al-Fuqaha, Kirk Dombrowski, and Mohammad Abu Shattal, “Social deference and hunger as mechanisms for starvation avoidance in cognitive radio societies.” *Wireless Communications & Mobile Computing* 12 (2016): 1063-68.
2. Bilal Khan and Zeki Bilgin, Performance comparison of two route optimisation schemes for AODV in MANETs. *International Journal of Communication Networks and Distributed Systems*, Volume 17 Issue 1, 2016, Pages 76-102
3. Anna Wisniewska and Bilal Khan. *Contention-sensing and Dynamic Spectrum Co-use in Secondary User Cognitive Radio Societies*, *Wireless Communications & Mobile Computing*, Pages 157-162, Nicosia, Cyprus, 2014.
4. Hesham Abed, Ala Al-Fuqaha, Bilal Khan, Ammar Rayes, Efficient Failure Prediction in Autonomic Networks Based on Trend and Frequency Analysis of Anomalous Patterns, *Int Journal of Network Management*, Vol. 23(3), 2013, pp 186-213.
5. Osama Awwad, Ala Al-Fuqaha, Bilal Khan and Ghassen Ben Brahim. Topology Control Schema for Better QoS in Hybrid RF/FSO Mesh Networks. *IEEE Transactions on Communications*, Vol. 60(5), 2012, Pages 1398-1406.
6. M. Ahmad, Ala Al-Fuqaha, Osama Awwad and Bilal Khan. Synergies of Radio Frequency and Free Space Optics Communication: New Hybrid Solutions for Next Generation Wireless Mesh Networks, *International Journal of Computer Networks*, Vol. 4(5), 2012.
7. Zeki Bilgin and Bilal Khan. Dynamic power budget distribution schemes that optimize connection lifetimes in MANETS, *International Journal of Autonomous and Adaptive Communication Systems*, Vol. 5(4), 2010, Pages 360-385.
8. Osama Awwad, Ala Al-Fuqaha, Ghassen Ben Brahim, Bilal Khan, Ammar Rayes. Distributed Topology Control in Large-Scale Hybrid RF/FSO Networks: SIMT GPU-Based Particle Swarm Optimization Approach, *Journal of Communication Systems*, Vol. 26(7), pp. 888-911, 2011.
9. Osama Awwad, Ala Al-Fuqaha, Bilal Khan, D. Kountanis and D. Benhaddou. “GPU-Based Particle Swarm Optimization for Topology Control in Hybrid RF/FSO Mesh Networks”, Proceedings of ICC, Capetown, South Africa, 2010.
10. Zeki Bilgin and Bilal Khan. “A Dynamic Route Optimization Mechanism for AODV in MANET”, Proceedings of ICC, Capetown, South Africa, 2010, Pages 1-5.
11. Zeki Bilgin and Bilal Khan. “Using Connection Expansion to Reduce Control Traffic in MANETs”, Proceedings of International Wireless Communications and Mobile Computing Conference, Caen, France, 2010, Pages 534-538.
12. Zeki Bilgin and Bilal Khan. “Only the Short Die Old: Route Optimization in MANETs by Dynamic Subconnection Shrinking”, Proceedings of International Wireless Communications and Mobile Computing Conference, Caen, France, 2010, Pages 681-685.
13. Zeki Bilgin and Bilal Khan. “Having ones cake and eating it too: Better routes and lower control traffic for AODV”, Proceedings of Med-Hoc-Net, Juan-Les-Pins, France, 2010, Pages 1-8.

14. Zeki Bilgin and Bilal Khan. "Balancing Power: Tradeoffs between Connection Lifetime and Control Traffic Overhead in MANETS", Proceedings of the IEEE International Conference on Communications, 2009, Pages 883-887.
15. O. Awwad, A. Al-Fuqaha, B. Khan, D. Benhaddou, M. Guizani, A. Rayes. "Bayesian-Based Game Theoretic Model to Guarantee Cooperativeness in Hybrid RF/FSO Mesh Networks", Proceedings of IEEE Globecom, Honolulu, Hawaii, 2009, pp 1-7.
16. A. Al-Fuqaha, B. Khan, M. Guizani, A. Rayes, O. Awwad, G. Ben Brahim. Opportunistic Channel Selection Strategy for Better QoS in Cooperative Networks with Cognitive Radio Capabilities, *IEEE Journal of Selected Areas in Communications*, 2008, Pages 156-167.
17. Ghassen Ben Brahim, A. Al-Fuquaha, M. Guizani and B. Khan. "A Model for Cooperative Mobility and Budgeted QoS in MANETs with Heterogenous Autonomy Requirements", Proceedings of Globecom, New Orleans, 2008, Pages 1-5.
18. Bilal Khan and Kiran Bhutani. "Designing scalable networks with multiple personalities", Proceedings of The 3rd International Conference on Mathematical Sciences, Dubai, UAE, 2008.
19. Zeki Bilgin and Bilal Khan. "Increasing Connection Lifetimes through Dynamic Distribution of Budgeted Power", Proceedings of the Int Wireless Communications and Mobile Computing Conference, Crete Island, 2008, pp 500-504.
20. Mohsen Guizani, Ghassen Ben Brahim, Al-Fuqaha, and Bilal Khan. "Surrendering Autonomy: Can Cooperative Mobility Help?" Proceedings of Euro-Par, 2007, Pages 901-910.
21. G. Ben Brahim, O. Awaad, A. Al-Fuquaha, B. Khan and M. Guizani. "Using MILP for Optimal Movement Planning in MANETs with Cooperative Mobility", Proceedings of IEEE Globecom Ad-hoc and Sensor Networking Symposium, Honolulu, Hawaii, 2007, Pages 1201-1205.
22. Ghassen Ben Brahim, Ala Al-Fuqaha, D. Kountanis and Bilal Khan. "A New Fuzzy-Based Cooperative Movement Model in Support of QoS in Wireless Ad-Hoc Networks", Proceedings of International Wireless Communications and Mobile Computing Conference, Honolulu, Hawaii, 2007, Pages 158-163.
23. Bilal Khan, Ghassen Ben Brahim and Ala Al-Fuqaha. "Multigrid Techniques for Movement Planning in MANETs with Cooperative Mobility", Proceedings of International Wireless Communications and Mobile Computing Conference, Honolulu, Hawaii, 2007, Pages 197-201.
24. Ghassen Ben Brahim, Bilal Khan, Ala Al-Fuqaha and Mohsen Guizani. Weak many vs. strong few: reducing BER through packet duplication in power-budgeted wireless connections, *Int Journal of Sensor Networks*, Vol. 4(3), 2006, Pages 145-154.
25. Bilal Khan and Ghassen Ben Brahim. "Budgeting Power: Packet Duplication and Bit Error Rate Reduction in Wireless Ad-Hoc Networks", Proceedings of the International Wireless Communications and Mobile Computing Conference, Vancouver, Canada, 2006, Pages 293-298.
26. Bilal Khan, Ghassen Ben Brahim, Ala Al-Fuqaha and Mohsen Guizani. "Using Energy-Efficient Overlays to Reduce Packet Error Rates in Wireless Ad-Hoc Networks", Proc of IEEE Conference on Communications, Istanbul, Vol. 8, 2006, Pages 3717-3722.

27. Bilal Khan, Ghassen Ben Brahim, Ala Al-Fuqaha and Mohsen Guizani. "Harnessing the Parity of Multiple Errors in End-to-End MAC Schemes", Proceedings of IEEE Globecom, 2006, Pages 1-5.
28. Bilal Khan, Ghassen Ben Brahim, Ala Al-Fuqaha and Mohsen Guizani. "Minimizing Wireless Connection BER through the Dynamic Distribution of Budgeted Power", Proceedings of IEEE Globecom, 2006, Pages 1-5.
29. Bilal Khan, Dardo D. Kleiner, David Talmage and Abdella Battou. "The Effect of Wavelength Advertisement on the Performance of an Optical Routing Protocol", Proceedings of IEEE Globecom, Vol. 3, 2004, Pages 1985-1988.
30. A. Battou, B. Khan, D. C. Lee, S. Mountcastle, D. Talmage and S. Marsh. CASiNO: component architecture for simulating network objects, *Software Practice and Experience*, Vol. 32(11), 2002, Pages 1099-1128.
31. A. Battou, B. Khan, D. C. Lee, S. Marsh, S. Mountcastle and D. Talmage. SEAN for modeling and simulating ATM Signaling, *Transactions of the Society for Computer Simulation*, Vol. 78(4), 2002, Pages 231-238.
32. Abdella Battou, Ghassen Ben Brahim and Bilal Khan. The Optical Network Control Plane, Chapter 5 in *Optical Switching/Networking and Computing for Multimedia Systems*, Marcel-Dekker, Abdella Battou and Mohsen Guizani, 2002, CRC Press, ISBN 978-0-8247-0707-1.
33. Bilal Khan, Dardo D. Kleiner and David Talmage. "OPTIPRISM: A Distributed Hierarchical Network Management System for All-Optical Networks", Proceedings of IEEE Globecom, San Antonio, Texas, Vol. 3, 2001, Pages 1531-1535.
34. Bilal Khan, David Talmage, Sean Mountcastle, Abdella Battou and Spencer Marsh. "Introducing PRouST: The PNNI Routing and Simulation Toolkit", Proceedings of IEEE Workshop on High Performance Switching and Routing, Dallas, Texas, 2001, Pages 335-341.
35. Abdella Battou, Kiran Bhutani and Bilal Khan. Two Approaches for Aggregation of Peer Group Topology in Hierarchical PNNI Networks, *International Journal of Intelligent Automation and Soft Computing*, Autosoft Press, Vol. 6(2), 2000, Pages 125-134.
36. Bilal Khan, Dardo D. Kleiner and David Talmage. "Towards a Distributed Hierarchical Network Management System for All-Optical Networks", Proceedings of 3rd International Workshop on Mobile Agents and Telecommunications Applications, Montreal, Canada, 2000.
37. G. Ben Brahim, B. Khan, A. Battou, M. Guizani and G. Chaudhry. "Routing Protocols for Optical Networks", Proc of IEEE Globecom, San Francisco, California, 2000.
38. G. Ben Brahim, B. Khan, A. Battou, M. Guizani and G. Chaudhry. "TRON: The Toolkit for Routing in Optical Networks", Proceedings of IEEE Globecom, San Antonio, Texas, Vol. 3, 2001, Pages 1445-1449.
39. A. Battou, B. Khan, D. Lee, S. Marsh, S. Mountcastle and D. Talmage. "Introducing SEAN: The Signaling Entity for ATM Networks", Proceedings of IEEE Globecom, San Francisco, California, 2000, Pages 532-537.
40. Abdella Battou, Bilal Khan and Sean Mountcastle. PNNI and the Optimal Design of High-speed ATM Networks, *Journal of Informatica*, Vol. 23(3), 1999.



41. A. Battou, B. Khan, D. Lee, S. Marsh, S. Mountcastle and D. Talmage. "CASiNO: A Component Architecture for Simulation of Network Objects", Proceedings of the Symposium on Performance Evaluation of Computer and Telecommunication Systems, Chicago, Illinois, 1999, Pages 261-272.
42. Baruch Awerbuch, Yi Du, Bilal Khan and Yuval Shavitt. Routing Through Networks with Hierarchical Topology Aggregation, *Journal of High Speed Networks*, Vol. 7(1), 1998, Pages 57-73.
43. Baruch Awerbuch, Yi Du, Bilal Khan and Yuval Shavitt. "Routing through teranode networks with topology aggregation", Proc. of IEEE Symposium on Computers and Communications Systems, Athens, Greece, 1998.

*Emergence of social organization within complex adaptive systems*

1. Bilal Khan, Yuri Kantor, Kirk Dombrowski, "Attractor-based obstructions to growth in homogenous cyclic Boolean automata." *Journal of Computer Science and System Biology* 8(6): 2015, 341-353.
2. Yuri Cantor, Bilal Khan, Kirk Dombrowski "Towards a Formal Understanding of Bateson's Rule: Chromatic Symmetry in Cyclic Boolean Networks and its Relationship to Organism Growth and Cell Differentiation" *Complex Adaptive Systems 4 (Procedia Computer Science)* 36, 476-483, 2014.
3. Bilal Khan and Kiran Bhutani. Additive Operations on Flow Graphs, AKCE International Journal of Graphs and Combinatorics, Volume 11(2), 2014.
4. Yuri Cantor, Bilal Khan and Kirk Dombrowski. Heterogeneity and its Impact on Thermal Robustness and Attractor Density, *Complex Adaptive Systems*, Vol. 6, 2011, pp 15-21.
5. Bilal Khan and Kiran Bhutani. Compression and Expansion in Graphs using Overlays. *Journal of Networks*, Vol. 58(1), 2011, Pages 36-42.
6. Richard Randall and Bilal Khan. Lerdahls Tonal Pitch Pace Model and Associated Metric Spaces. *Journal of Mathematics and Music*, Vol. 4(3), 2010, Pages 121-131.
7. Bilal Khan and Kiran Bhutani. "Sparse Periodic Goldbach Sets", Proceedings of The Third International Conference on Mathematical Sciences, Dubai UAE, 2008.
8. Bilal Khan and Kiran Bhutani. "Graphic Arithmetic II: +Irreducibility, Canonical Decompositions and Cancellation Laws", Proceedings of The Third International Conference on Mathematical Sciences, Dubai UAE, 2008.
9. Bilal Khan, Alexei Miasnikov and Denis Serbin. On positive theories of groups with regular free length functions, *Journal of Computation and Algebra*, Vol. 17(1), 2007, Pages 1-26.
10. Bilal Khan, Kiran Bhutani, Delaram Kahrobaei. A Graphic Generalization of Arithmetic, *Electronic Journal of Combinatorial Number Theory*, Vol. 7(12), 2007, Pages 1-31.
11. Richard Randall and Bilal Khan. "Similarity Measures for Tonal Models", Proceedings of the 9th Int Conference on Music Perception and Cognition, Bologna, Italy, 2006.
12. Kiran Bhutani, Bilal Khan. Distance Between Graphs Using Graph Labelings, *Ars*

*Combinatoria*, Vol. 77, 2005, Pages 45-52.

13. Bilal Khan. "Computation with Polytopal Uncertainty in d-Dimensional Euclidean Space", Proceedings of 9<sup>th</sup> World Conference on Systemics, Cybernetics and Informatics, Orlando, Florida, 2005.
14. Kiran Bhutani, Bilal Khan. A Metric on the Class of Connected Simple Graphs of Given Order, *Aequationes Mathematicae*, Vol. 66(3), 2003, Pages 232-240.
15. Bilal Khan. The Structure of Automorphic Conjugacy in the Free Group of Rank Two, *Contemporary Mathematics*, Vol. 349, 2003, Pages 115-196.
16. Kiran Bhutani, Bilal Khan. Optimal distribution of a hierarchy of management agents, *Journal of Information Sciences*, Vol. 149(4), 2003, Pages 235-248.
17. Kiran Bhutani, Bilal Khan and Birendro Roy. "Tradeoffs in Load Balancing and Communication Minimization for Multi-Agent Systems", Proceedings of International Conference on Parallel and Distributed Computing and Systems, Massachusetts Institute of Technology, Cambridge Massachusetts, 2002, Pages 363-368.
18. Kiran R. Bhutani and Bilal Khan. "Minimizing Communication Costs in Hierarchical Multi-Agent Systems", Proceedings of Joint Conference on Information Sciences, Chapel Hill, North Carolina, 2002, Pages 1435-1442.
19. Bilal Khan. Positively Generated Subgroups of Free Groups and the Hanna Neumann Conjecture, *Contemporary Mathematics*, Vol. 296, 2002, Pages 155-170.

#### *Co-evolution of computer malware and operating systems*

1. Jeremy Seideman, Bilal Khan, and Cesar Vargas. Quantifying Malware Evolution through Archaeology, *Journal of Information Security*, 6.02 (2015): 101.
2. Jeremy Seideman and Bilal Khan. *Identifying Malware Genera using the Jensen-Shannon Distance Between System Call Traces*, Proceedings of MALCON: International Conference on Malicious and Unwanted Software, Fajardo, Puerto Rico.
3. Jeremy Seideman and Bilal Khan. *Malware Biodiversity*, Proceedings of MALCON: 9th International Conference on Malicious and Unwanted Software, Fajardo, Puerto Rico.
4. Jeremy Seideman, Bilal Khan, Ghassen Ben Brahim. "Determining vulnerability resolution time by examining malware proliferation rates", Int. Wireless Communications and Mobile Computing Conference, Sardinia, July 2013, Pages 1678-1682.
5. Omer Demir, Bilal Khan, Ala Al-Fuqaha, Ghassen Ben Brahim. "Optimizing Agent Placement for Flow Reconstruction of DDoS Attacks", Int. Wireless Communications & Mobile Computing Conference, Sardinia, July 2013, Pages 83-89.
6. Omer Demir and Bilal Khan. "Finding DDoS attack sources: Searchlight localization algorithm for network tomography", Proceedings of International Wireless Communications and Mobile Computing Conference, 2011, Pages 418-423.
7. Yuri Cantor, Nancy Griffeth and Bilal Khan. "Securing BGP Through Existing

Infrastructure and Contractual Chains”, Proceedings of the Computers, Freedom, and Privacy conference, 2010.

8. Omer Demir and Bilal Khan. “Quantifying Distributed System Stability through Simulation: A Case Study of an Agent-Based System for Flow Reconstruction of DDoS Attacks”, Proceedings of Conference on Intelligent Systems, Modeling and Simulation, 2010, Pages 312-317.
9. Omer Demir and Bilal Khan. “Reconstruction of Malicious Internet Flows”, Proceedings of International Wireless Communications and Mobile Computing Conference, Caen, France, 2010, Pages 1182-1187.
10. Jaroslaw Paduch, Jamie Levy and Bilal Khan. “Using a Secure Permutational Covert Channel to Detect Local and Wide Area Interposition Attacks”, Proceedings of International Wireless Communications and Mobile Computing Conference Computer and Network Security Symposium, 2009, Pages 79-83.
11. Jamie Levy, Jaroslaw Paduch and Bilal Khan. “Superimposing Permutational Covert Channels onto Reliable Stream Protocols”, Proceedings of MALWARE, 2008, Pages 49-56.
12. Joel Sandin and Bilal Khan. “Petrifying Worm Cultures: Scalable Detection and Immunization in Untrusted Environments”, Proceedings of IEEE International Conference on Communications, 2007, Pages 1423-1428.
13. Jamie Levy and Bilal Khan. “Hiding Your Wares: Transparently Retrofitting Memory Confidentiality into Legacy Applications”, Proceedings of IEEE International Conference on Communications, 2007, Pages 1368-1372.
14. Delaram Kahrobaei and Bilal Khan. “A Non-Commutative Generalization of ElGamal Key Exchange using Polycyclic Groups”, Proceedings of IEEE Globecom, 2006, Pages 1-5.
15. Bilal Khan, Dardo D. Kleiner and David Talmage. “The Buck Stops Here: Trust Management in Multi- Agent Systems with Accountability”, Proceedings of IEEE Symposium on Multi-Agent Security and Survivability, Philadelphia, Pennsylvania, 2004, Pages 46-54.

## POLICY PAPERS

1. Meredith Dank, Bilal Khan, Mitch Downey, Cybele Kotonias, Debbie Mayer, Colleen Owens, Laura Pacifici, Lilly Yu. Estimating the Size and Structure of the Underground Commercial Sex Economy in Eight Major US Cities. Report to the National Institute of Justice, 2014, 412 pages.
2. Kirk Dombrowski, Bilal Khan, Joshua Moses, Emily Channell, Katherine McLean, and Evan Misshula. The Nain Networks Project. Report to the Nunatsiavut Research Committee, Nain Labrador, 2011, 194 pages.
3. Bilal Khan, Kirk Dombrowski, Mohamed Saad, Katherine McLean, Evan Misshula, Ric Curtis, Travis Wendel, William Jett. IDU Network Topologies and HIV Stabilization Dynamics. Report to NIH NIDA. 2011, 215 pages.

4. Travis Wendel, Bilal Khan, Kirk Dombrowski, Ric Curtis, and Katherine McLean. Dynamics of Methamphetamine Markets in New York City. Report to the National Institute of Justice, 2011, 221 pages.
5. R. Curtis, M. Dank, B. Khan, and K. Terry. Commercial Sexual Exploitation of Children in New York City, Volume 1: CSEC Population in New York City, Size, Characteristics, and Needs. National Center for Court Innovation, 2008, 125 pages.

#### UNDERGRADUATE TEACHING

- Probability and Statistics
- Combinatorics and Graph theory
- Databases
- Algorithms
- Object oriented programming
- Android/iOS programming
- Cybersecurity

#### GRADUATE TEACHING

- Modeling and Simulation
- Networks
- Data Mining
- Machine Learning
- Network security and forensics
- Operating system security
- Networks

#### SUPERVISION & MENTORSHIP OF GRADUATE RESEARCH

##### **Doctoral Students**

Anna Wisniewska, (in progress, Advisor).

Applying Behavioral-Ecological Models to Cognitive Radio Networks

Yuri Cantor, (in progress, Advisor).

Thermal Noise and Heterogeneity in Discrete Dynamical Systems

Jeremy Seideman, (in progress, Advisor).

Towards a Theory of Natural Selection and Evolution in Malware

Deniz Sarioz (Committee Member), Obstacle representations of graphs, 2013

Mohamed Saad, 2010, Advisor

Secure Critical Care Resource Optimization based on Heterogeneous Vital Signs

Zeki Bilgin, 2010, Advisor

Improving Performance of Active MANET Connections through Dynamic Route Optimization and Maintenance

Omer Demir, 2009, Advisor

A Scalable Agent-based System for Network Flow Reconstruction with Application to the Structure and Dynamics of Distributed Denial of Service Attacks

Enzo Sainato (Committee Member), Situational Surveillance Control, Department of Criminal Justice, John Jay College of Criminal Justice, 2009.

Eman Abdu, 2009, Advisor

Clustering Categorical Data using Summaries and Spectral Techniques

## Masters Students

Tamer Oguz, 2014, Advisor  
New methods for dynamic efficient link sampling of social networks

Fatih Istikas, 2014, Advisor  
Towards scalable forensics using subspace clustering of files

Cesar Vargas, 2014, Advisor  
Analyzing Cryptophylogenies of Android malware

Jessica Jacquez, 2014, Advisor  
Towards Scalable E-Discovery using Content-based Hierarchical File Clustering

Cindy Zimmerman, 2012.  
An Evaluation of Private-Sector Digital Forensics Processes and Practices

David Chan, 2011.  
A prototype EEG platform for Cognitive Forensics

Carol Dottin, 2009.  
Cooperative Networking and Control for Emergency Response Teams

Juseop Lim, 2008.  
A Feasibility Study on Wireless Device Location using a Single Directional Wireless Antenna

Jaroslav Paduch, 2008.  
Covert channels using IP packet permutations

Jamie Levy, 2007.  
METAL: Transparent Memory Encryption  
REFERENCES

Kiran Bhutani,  
Professor of **Mathematics**,  
The Catholic University of America,  
[bhutani@cua.edu](mailto:bhutani@cua.edu)

Kirk Dombrowski  
Professor of **Sociology**,  
University of Nebraska-Lincoln  
[kirkdombrowski@gmail.com](mailto:kirkdombrowski@gmail.com)

Richard Lovely  
Director of Digital Forensics & **Cybersecurity**  
Program  
John Jay College, CUNY  
[rlvely@jjay.cuny.edu](mailto:rlvely@jjay.cuny.edu)

Holly Hagan  
Professor of **Epidemiology**  
College of Nursing  
New York University  
[hh50@nyu.edu](mailto:hh50@nyu.edu)

Ala Al-Fuqaha.  
Professor of **Computer Science**,  
University of Western Michigan.  
[ala.al-fuqaha@wmich.edu](mailto:ala.al-fuqaha@wmich.edu)

Ric Curtis,  
Professor of **Anthropology**  
John Jay College, CUNY  
[ric.curtis@gmail.com](mailto:ric.curtis@gmail.com)