Gibran Hemani

Senior Research Fellow, University of Bristol

8 Picton Mews, Bristol, BS6 5PB, United Kingdom

+44(0)7930951876 | explodecomputer@gmail.com | explodecomputer.com | explodecomputer | explodecomputer

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Education

University of Bristol — *Bristol*

Associate of the Higher Education Academy, UK — *Sep-19 to Mar-20*

University of Edinburgh — *Edinburgh*

PhD in Quantitative Genetics — *Oct-07 to Aug-11*

University of Nottingham — *Nottingham*

BSc (hons) 2:1 — *Sep-03 to Jun-06*

Employment

MRC Integrative Epidemiology Unit, University of Bristol — *UK*

Senior research fellow — *Jan-18 to present*

MRC Integrative Epidemiology Unit, University of Bristol — *UK*

Research fellow — *Jan-14 to Dec-17*

Queensland Brain Institute, University of Queensland — *Australia*

Post doctoral statistical geneticist — *Jan-12 to Dec-13*

Awards

Sir Kenneth Mather Memorial prize — *The Genetics Society*

Best PhD thesis in quantitative and population genetics — *2011*

Teaching

Though I have only had research-based academic appointments, I have found many opportunities to develop a variety of different teaching materials from my PhD to present. While at the University of Bristol I received invitations to develop and deliver week-long courses to researchers at the Wellcome Genome Campus, and institutions in Italy (with one other person), Brazil (coordinating a group of teachers) and South Africa (with one other person). I have also developed and directed a 20-credit module on genomic data science for intercalating medical students at the University Bristol, training students in critical reasoning and computer programming. I am leading the Anti-Racism special interest group in Decolonising the Curriculum, whose plans I detail at the end of the CV.

(i) Undergraduate and taught postgraduate (past 3 years)

Evidence Based Medicine unit in MB ChB programme — *University of Bristol*

Tutor — *2020*

Genes and behaviour (PSYC30018) — *University of Bristol*

Lecturer — *2018, 2019*

- Wrote and delivered three lectures on molecular genetics

Genomic Medicine iBSc — *University of Bristol*

Pastoral tutoring — *2017, 2018*

- Two students on the Genomic Medicine iBSc

Genomic Data Science unit in Genomic Medicine iBSc *University of Bristol*

Course lead *2016-2018, 2020*

- Led, co-wrote and delivered 4-week module (20 credits) to intercalating medical, dentistry and veterinary students
- Organised material for several lecturers on programming, statistics, genetic analysis
- Set assessments
- Delivered lectures, tutorials, practicals, assessed debate
- Transitioned to flipped classroom format.

(ii) Major teaching responsibilities in previous years

Statistical genetics unit in Biomedical Capstone Course *University of Queensland*

Course lead *2012, 2013*

- Wrote four lectures and two workshops on GWAS written
- Delivered to 250 undergraduate students (3rd year)
- Set and marked assessments
- Delivered lectures and practicals.

(iii) Innovatory units and teaching methods

Flipped classroom: In the second year of the iBSc Genomic Medicine course I redesigned the R programming training section to be a flipped classroom, using online games for students to learn the basic principles of programming at home and the tutor led sessions as an opportunity to synthesise those skills into applied examples. The students were more adept at programming than in the previous year, and also more enthused about the subject. I transitioned the rest of the module to a flipped classroom in 2020 during the Covid-19 pandemic.

(iv) Contribution to Life-long learning and continuing professional development courses

Short courses that I have (co-)written and led in the last 3 years

Genetic Analysis of Population-based Association Studies short course, *Wellcome Genome Campus*

Course co-lead *2018-2020*

- Invited to co-lead a course that has been running for 12 years, approx
- 40 international participants

MR-Base workshop, MR conference *Bristol*

Course lead *2017, 2019*

- Wrote and delivered lectures and tutorials on how to use the MR-Base database and R packages
- Approx 60 international participants

Genetic Epidemiology short course at EEPE *Florence, Italy*

Course co-lead *2016-2018*

- Co-wrote and delivered (with Prof Dave Evans) 5-day course to 20 (approx) researchers
- Prepared and delivered lectures + practicals.

UNIX and Genetic epidemiology *Pelotas, Brazil*

Course co-lead *2015*

- Co-wrote and delivered 7-day course to 30 (approx) researchers
- Lectures and practicals

Genetic epidemiology, H3Africa project *Johannesberg, South Africa*

Course co-lead *2014*

- Co-wrote and delivered (with Dr Nic Timpson) 5-day course to 30 (approx) researchers
- Delivered lectures and practicals.

Introduction to R *University of Edinburgh*

Course co-lead *2009*

- Co-wrote and delivered (with Joseph Powell) 2-day short course on R programming

Lecturing contributions

Statistical methods for mediation short course *University of Bristol*

Lecturer *2017, 2018*

- One lecture + practical

Genomic medicine iBSc *University of Bristol*

Lecturer *2016-2018, 2020*

- Three lectures to other units

Statistical genetics short course *University of Bristol*

Lecturer *2015-2019*

- Two lectures + practicals

Mendelian randomisation short course *University of Bristol*

Lecturer *2014-2020*

- Two lectures + practicals

18th Summer Institute in Statistical Genetics *Seattle USA*

Teaching assistant *2013*

- Teaching assistant for: "Human Complex Traits" and "Animal Genetic Data Analysis"

Introduction to git and programming workflows *University of Queensland*

Workshop lead *2013*

- One-day workshop

Introduction to Statistics *University of Queensland*

Lecturer *2012*

- Professional Development Course

(v) Collaborative teaching projects

Developed external speaker programmes for iBSc medical students, involving Jeff Barrett from OpenTargets and the Sanger Institute; Rob Scott from GlaxoSmithKlein; and Jonathan Ives from the Centre for Ethics in Medicine.

(iv) Postgraduate advising

PhD Supervision

Lily Andrews

CRUK *2020-2024*

- Secondary supervisor

Amanda Forde

Science Foundation Ireland *2020-2024*

- Secondary supervisor

Chris Moreno-Stokoe

BBSRC *2018-2022*

- Secondary supervisor

Hannah Wilson

BBSRC and GSK *2017-2021*

- Primary supervisor

Thomas Battram

Wellcome Trust *2016-2020*

- Primary supervisor

Laurence Howe

Wellcome Trust *2014-2018*

- Secondary supervisor
- Awarded best doctoral research prize 2018/2019 in Faculty of Health Sciences

Mini projects

Ben Towers
iBSc student *2018*

Mahsa Sheikhali Babaei
PhD student *2017*

Zoe Reed
PhD student *2016*

Alexandra Binder
Visiting researcher from Harvard *2015*

(vii) Major achievements in teaching administration

Anti-racism: I co-lead the Special Interest Group on decolonising the curriculum in the Bristol Medical School. I am creating a framework by which course leads across the school can identify racial biases in their teaching methods and materials, work towards address them, and obtain independent course review from external peers.

Courses on my software: I developed a course to teach researchers how to use my own software (MR-Base), with the course being heavily over-subscribed and gaining very positive feedback and increased usage of the software.

Research and related administration

I was awarded a Wellcome Trust Sir Henry Dale fellowship award in 2018. I have translated my background in quantitative genetics and high performance computing to genetic epidemiology research, resulting in the development of the MR-Base causal inference analytical platform and OpenGWAS data infrastructure. This software is used by researchers within the institute and around the world, has led directly to funding for five post-doctoral positions from three private companies (GSK, Biogen, CHDI). I currently lead or co-lead two major international collaborations: The GoDMC consortium comprising 56 cohorts analysing the genetics of DNA methylation; the OpenGWAS consortium that combines the resources of over 100 groups and consortia.

(i) Publications

Full publication list on google scholar: https://scholar.google.com/citations?user=6fC0BYYAAAAJ&hl=en.

- H-index: **44**
- i10-index: **84**
- Number of publications: **153**

Selected publications below, organised by category and contribution

Academic journal papers (refereed, first or joint first author) Hemani, G., Zheng, J., Elsworth, B., Wade, K., Haberland, V., Baird, D., & others. (2018). *Elife*, *7, e34408*.

Hemani, G., Tilling, K., & Davey Smith, G. (2017). *PLoS Genetics*, *13 (11), e1007081*.

Gaunt, T., Shihab, H., Hemani, G., Min, J., Woodward, G., Lyttleton, O., & others. (2016). *Genome Biology*, *17 (1), 1-14*.

Hemani, G., Shakhbazov, K., Westra, H., Esko, T., Henders, A., McRae, A., & others. (2014). *Nature*, *508 (7495), 249-253*.

Hemani, G., Knott, S., & Haley, C. (2013). *PLoS Genet*, *9 (2), e1003295*.

Hemani, G., Yang, J., Vinkhuyzen, A., Powell, J., Willemsen, G., Hottenga, J., & others. (2013). *The American Journal of Human Genetics*, *93 (5), 865-875*.

Hemani, G., Theocharidis, A., Wei, W., & Haley, C. (2011). *Bioinformatics*, *27 (11), 1462-1465*.

Academic journal papers (refereed, Senior or joint senior author) Griffith, G., Morris, T., Tudball, M., Herbert, A., Mancano, G., Pike, L., Sharp, G., & others. (2020). *medRxiv*.

Lawson, D., Davies, N., Haworth, S., Ashraf, B., Howe, L., Crawford, A., & others. (2020). *Human Genetics*, *139 (1), 23-41*.

Morris, T., Davies, N., Hemani, G., & Smith, G. (2020). *Science Advances*, *6 (16), eaay0328*.

Zheng, J., Haberland, V., Baird, D., Walker, V., Haycock, P., Hurle, M., & others. (2020). *Nature Genetics*, *52 (10), 1122-1131*.

Anderson, E., Howe, L., Wade, K., Ben-Shlomo, Y., Hill, W., Deary, I., & others. (2020). *International Journal of Epidemiology*, *49 (4), 1163-1172*.

Brumpton, B., Sanderson, E., Heilbron, K., Hartwig, F., Harrison, S., Vie, G., & others. (2020). *Nature Communications*, *11 (1), 1-13*.

Cho, Y., Haycock, P., Sanderson, E., Gaunt, T., Zheng, J., Morris, A., & others. (2020). *Nature Communications*, *11 (1), 1-13*.

Russell, A., Ford, T., Gunnell, D., Heron, J., Joinson, C., Moran, P., Relton, C., & others. (2020). *Brain, Behavior, and Immunity*.

Howe, L., Richardson, T., Arathimos, R., Alvizi, L., Passos-Bueno, M., & others. (2019). *Epigenomics*, *11 (2), 133-145*.

Howe, L., Lawson, D., Davies, N., Pourcain, B., Lewis, S., Smith, G., & others. (2019). *Nature Communications*, *10 (1), 1-10*.

Richardson, T., Haycock, P., Zheng, J., Timpson, N., Gaunt, T., & others. (2018). *Human Molecular Genetics*, *27 (18), 3293-3304*.

Howe, L., Lee, M., Sharp, G., Smith, G., St Pourcain, B., Shaffer, J., & others. (2018). *PLoS Genetics*, *14 (8), e1007501*.

Ye, J., Richardson, T., McArdle, W., Relton, C., Gillespie, K., Suderman, M., & others. (2018). *Journal of Autoimmunity*, *93, 66-75*.

Richardson, T., Zheng, J., Smith, G., Timpson, N., Gaunt, T., Relton, C., & others. (2017). *The American Journal of Human Genetics*, *101 (4), 590-602*.

Academic journal papers (refereed, main analytical or design contribution) Richardson, T., Hemani, G., Gaunt, T., Relton, C., & Smith, G. (2020). *Nature Communications*, *11 (1), 1-11*.

Richardson, T., Harrison, S., Hemani, G., & Smith, G. (2019). *Elife*, *8, e43657*.

Morris, A., Le, T., Wu, H., Akbarov, A., Most, P. van der, Hemani, G., & others. (2019). *Nature Communications*, *10 (1), 1-14*.

Taylor, D., Jackson, A., Narisu, N., Hemani, G., Erdos, M., Chines, P., & others. (2019). *Proceedings of the National Academy of Sciences*, *116 (22), 10883-10888*.

Min, J., Hemani, G., Davey Smith, G., Relton, C., & Suderman, M. (2018). *Bioinformatics*, *34 (23), 3983-3989*.

Haas, M., Aragam, K., Emdin, C., Bick, A., Hemani, G., Smith, G., & others. (2018). *The American Journal of Human Genetics*, *103 (4), 461-473*.

Noyce, A., Kia, D., Hemani, G., Nicolas, A., Price, T., De Pablo-Fernandez, E., & others. (2017). *PLoS Medicine*, *14 (6), e1002314*.

White, J., Sofat, R., Hemani, G., Shah, T., Engmann, J., Dale, C., Shah, S., & others. (2016). *The Lancet Diabetes & Endocrinology*, *4 (4), 327-336*.

Yang, J., Bakshi, A., Zhu, Z., Hemani, G., Vinkhuyzen, A., Lee, S., & others. (2015). *Nature Genetics*, *47 (10), 1114*.

Robinson, M., Hemani, G., Medina-Gomez, C., Mezzavilla, M., Esko, T., & others. (2015). *Nature Genetics*, *47 (11), 1357-1362*.

Visscher, P., Hemani, G., Vinkhuyzen, A., Chen, G., Lee, S., Wray, N., & others. (2014). *PLoS Genet*, *10 (4), e1004269*.

McRae, A., Powell, J., Henders, A., Bowdler, L., Hemani, G., Shah, S., & others. (2014). *Genome Biology*, *15 (5), R73*.

Speed, D., Hemani, G., Johnson, M., & Balding, D. (2012). *The American Journal of Human Genetics*, *91 (6), 1011-1021*.

Review articles (main author) Hemani, G., Bowden, J., & Davey Smith, G. (2018). *Human Molecular Genetics*, *27 (R2), R195-R208*.

Richmond, R., Hemani, G., Tilling, K., Davey Smith, G., & Relton, C. (2016). *Human Molecular Genetics*, *25 (R2), R149-R156*.

Davey Smith, G., & Hemani, G. (2014). *Human Molecular Genetics*, *23 (R1), R89-R98*.

Wei, W., Hemani, G., & Haley, C. (2014). *Nature Reviews Genetics*, *15 (11), 722*.

(ii) Forthcoming publications

First or joint first author Min, J., Hemani, G., Hannon, E., Dekkers, K., Castillo-Fernandez, J., Luijk, R., & others. (2020). *medRxiv*.

Hemani, G., Bowden, J., Haycock, P., Zheng, J., Davis, O., Flach, P., Gaunt, T., & others. (2017). *BioRxiv*, *173682*.

Senior or joint Senior author Elsworth, B., Lyon, M., Alexander, T., Liu, Y., Matthews, P., Hallett, J., Bates, P., & others. (2020). *bioRxiv*.

Lyon, M., Andrews, S., Elsworth, B., Gaunt, T., Hemani, G., & Marcora, E. (2020). *BioRxiv*.

Battram, T., Gaunt, T., Speed, D., Timpson, N., & Hemani, G. (2020). *bioRxiv*.

Sanderson, E., Richardson, T., Hemani, G., & Smith, G. (2020). *BioRxiv*.

Selected published open source software

AscRtain *2020*

- Sensitivity analysis for collider bias in observational data
- https://github.com/explodecomputer/epigpu

GoDMC *2019*

- Website and API for querying genetic assocations with DNA methylation
- http://mqtldb.godmc.org.uk/

MR-TRYX *2019*

- Exploiting horizontal pleiotropy in Mendelian randomization
- https://explodecomputer.github.io/tryx/

OpenGWAS *2019*

- The OpenGWAS data infrastructure
- https://gwas.mrcieu.ac.uk/

USS pension model *2018*

- Web-app for projected pensions across different valuations
- http://www.uss-pension-model.com/

ALSPAC data dictionary *2017*

- R package and web-app for searching for ALSPAC variables
- http://variables.alspac.bris.ac.uk/

MR-Base *2016*

- Automated Mendelian randomization
- https://www.mrbase.org/

simulateGP *2016*

- Simulation methods for genotype-phenotype associations
- https://explodecomputer.github.io/simulateGP/

gctaPower *2013*

- Power calculations for genomic REML analysis
- https://shiny.cnsgenomics.com/gctaPower/

epiGPU *2012*

- Exhaustive searches for genetic interactions parallelised across graphics cards
- https://github.com/explodecomputer/epigpu

(iii) Research grants

Total income as PI, from 5 grants: **2,176,539 GBP**

Total income as CI, from 5 grants: **1,480,672 GBP**

Genetic architecture of Huntington's disease progression (Contracts pending)

Cure Huntington's Disease Initiative *2021-01-01 to 2022-12-31*

- Amount: 598,881 GBP
- Role: PI

Aetiological Epidemiology

Biogen *2020-09-01 to 2022-08-31*

- Amount: 284,525 GBP
- Role: Co-I

The causal map of the human phenome

Wellcome Trust and Royal Society, Sir Henry Dale Fellowship *2018-01-04 to 2023-06-30*

- Amount: 1,356,578 GBP
- Role: PI

Classifying mechanisms of pleiotropy to improve causal modelling

BBSRC and GlaxoSmithKline, CASE studentship *2017-10-01 to 2021-09-30*

- Amount: 100,000 GBP
- Role: PI

Pathways to self-harm: Biological mechanisms and genetic contribution

Medical Research Councal and Medical Research Foundation *2017-10-01 to 2019-10-01*

- Amount: 372,334 GBP
- Role: Co-I

Identification of Traits and Biomarkers for Prediction of Huntington's Disease Phenotypes using Novel causal analysis Methodologies

Cure Huntington's Disease Initiative *2017-04-01 to 2019-03-31*

- Amount: 117,059 GBP
- Role: Co-I

Translation of MR for drug target identification; De- tails

GlaxoSmithKline *2017-01-01 to 2020-01-01*

- Amount: 349,099 GBP
- Role: Co-I

Translation of MR for drug target identification

Biogen *2017-01-01 to 2020-01-01*

- Amount: 436,165 USD
- Role: Co-I

Dissecting genetic interactions in gene expression

University of Queensland, Early Career Research Grant *2013-01-01 to 2013-12-31*

- Amount: 34,000 AUD
- Role: PI

Dissecting genetic interactions in complex traits

CASE Studentship, BBSRC and Monsanto *2007-09-01 to 2011-08-30*

- Amount: 100,000 GBP
- Role: PI

(iv) Indications of external recognition

Editorships

Invited guest editor for PLoS Computational Biology *2017*

Appointment to national or international bodies

EDDRP chip design committee *2019*

- Invitation to a committee for designing the genotyping array for the Early Disease Detection Research Project, which will genotype 5 million UK participants by 2024

Invitations for degree examinations

Jisu Shin *University of South Australia*

Dissertation of Master of precision medicine *2020*

Edward Steere *Wittswatersrand University, SA*

Dissertation of Master of Science in Engineering *2016*

Invited lectures (last 3 years)

(vi) Related administration

Leading group on Covid-19 epidemiology

MRC IEU *2020 to present*

- Initiated project, and recruited group of 12 researchers
- Provided analysis of ZOE symptom tracker app for external collaborators
- Culminated in four publications, numerous presentations including to SAGE and HDRUK

Initiating the OpenGWAS consortium

MRC IEU *2020 to present*

- The OpenGWAS data infrastructure receives 2 million queries per week
- The consortium brings together researchers who develop software for GWAS summary data
- Plans to expand the invitation to international collaborators

Member of the UoB Covid modelling subgroup

University of Bristol *2020 to present*

SEGEG conference organiser

South of England Genetic Epidemiology Group *2019*

- Organised the long-running SEGEG conference to be held in Bristol for the first time

Leading work package on MR method development (programme 1)

MRC IEU *2018 to present*

- Line managing one post doctoral scientist

Leading statistics and informatics theme in epigenetics programme 4

MRC IEU *2018 to present*

Leading Hemani research group

MRC IEU *2018 to present*

- Four post-docs and four PhD students
- Weekly group meetings including pastoral and career support

ALSPAC Board of Directors

ALSPAC *2017 to present*

Leading genetics work package

ALSPAC *2017 to present*

- Line managing one post doctoral scientist

Academic leadership and citizenship

(i) Academic leadership in the discipline

Lead *University of Bristol*

OpenGWAS project *2020 to present*

- Software and data coordination across 100+ groups

Co-lead *University of Bristol*

MR within-family working group *2018 to present*

- Co-leading international group of 20+ genetic family studies, over 100,000 sibling pairs

Co-lead *University of Bristol*

Genetics of DNA methylation consortium *2015 to present*

- Co-leading international group of 56 cohorts in genetic and epigenetic association analysis

Co-lead *University of Bristol*

MR-Base *2015 to present*

- Co-leading GWAS summary data repository comprising >70 GWAS consortia

(ii) Academic leadership in the University

Group member *University of Bristol*

Medical Anti-Racism Taskforce *2020 to present*

- Leading Special interest group on decolonising the curriculum

Software developer *University of Bristol*

UoB Covid-19 Situation Report *2020 to present*

- Web app developed for internal use that provides daily updates and case mapping
- Used daily by the Incident Management Team in targeting Covid-19 actions

Group member *University of Bristol*

BRMS Equality Diversity Inclusion group *2018 to present*

- Working in career progression subgroup

Software developer *University of Bristol*

USS pension calculator *2018 to present*

- Developed a web-app that allows members of the USS pension scheme to calculate changes to the pension under proposed valuation changes
- Used widely by universities across the country
- http://www.uss-pension-model.com/

Reviewer *University of Bristol*

Teaching peer review *2018*

- Causal inference short course, University of Bristol

(iii) Professional activities outside the University

2019 -	Contributing to the design for the Early Disease Detection Research Programme that will be used to genotype up to 5 million people in the UK
2017 -	Regular peer review for various grant bodies including the MRC, Wellcome Trust, Cancer Research UK
2012 -	Regular contributor to open source software projects (e.g. see https://github.com/explodecomputer/random-metal and https://github.com/explodecomputer/ldsc/)
2011 -	Regular peer review for 20+ academic journals

(iv) Contributions to society

2017 - 2019	Regularly provide private accommodation for asylum seekers and refugees through the *Refugees at Home* charity
2015 -	Contributing member to the charity *Statisticians Without Borders*
2014 -	Provide web and software support to local vegan organisations

(v) Entrepreneurship, enterprise and partnerships

2015 -	I have formal partnerships with GlaxoSmithKlein, Biogen, Pfizer and CHDI that arose through developing the MR-Base platform. This has led to five post-doctoral positions and one PhD position being funded by these organisations, and the development of a standardised contract system to enable future such collaborations to occur.

(vi) Good citizenship

2020	Developed software for the University's Incident Management Team which maps new Covid-19 cases amongst students across the region in real time. This software is used in daily team management meetings
2020	Leading a Special Interest Group on Decolonising the Curriculum, which will bring in a framework for all courses across the medical school for dealing with implicit bias within their learning materials
2020	Member of the Bristol Clear mentoring scheme (currently mentoring two early career researchers)
2016 -	Participated in numerous mock interview panels for research fellowships
2015 -	Extensive software development for the MRC IEU research community, most notably the MR-Base software platform which I created and maintain for others to use. I am pleased that this has grown to be a platform for numerous research papers, and contributed substantially to research grants, many of which I am not named on
2014 -	Voluntary curation and documentation of shared data resources
2014 -	Web and software development for the ALSPAC project (e.g. see http://variables.alspac.bris.ac.uk/ and https://github.com/explodecomputer/alspac)
2014 -	Throughout my time in Bristol I have made it a priority to provide informal training to early career researchers, particularly in genetics, software development and reproducible research.

Future plans

My fellowship is focused on implementing causal inference on a phenome-wide scale, creating a graph of the causal estimates of every phenotype against every other phenotype. I will create collaborations within the University and externally with experts in artificial intelligence, to explore new ways to exploit this graph for biological understanding and medical applications. I will use my causal graph to develop new ways to engage with the public, exploring how perceived ideas of medical interventions would shape future trajectories of population disease burden.

I plan to develop a new professional development course that guides junior researchers and post-graduate students through best practices in code and data management and reproducible digital research.

Through leading the special interest group on decolonising the curriculum, my goal is to develop a method of accreditation for courses across the medical school to introspectively examine potential biases in their teaching materials, identify ways of addressing them, and seek external review of proposed changes. This is a project of crucial importance for equiping the graduates and trainees in redressing biases that continue to incur health inequalities between ethnic groups.

Arrow, K. J. (1986). Rationality of self and others in an economic system. *The Journal of Business*, *59*(4), 385–399.

Aumann, R., & Brandenburger, A. (1995). Epistemic conditions for nash equilibrium. *Econometrica*, *63*(5), 1161–1180.

Aumann, R. J. (1976). Agreeing to disagree. *The Annals of Statistics*, *4*(6), 1236–1239. `https://doi.org/doi:10.1214/aos/1176343654`

Bacharach, M. (1992). The acquisition of common knowledge. In C. Bicchieri & M. L. Dalla Chiara (Eds.), *Knowledge, belief and strategic interaction* (pp. 285–316). Cambrige University Press.

Basu, K. (1988). Strategic irrationality in extensive games. *Mathematical Social Sciences*, *15*, 247–260.

Bernheim, B. D. (1984). Rationalizable strategic behaviour. *Econometrica*, *52*(4), 1007–1028.

Bicchieri, C. (1989). Self-refuting theories of strategic interaction: A paradox of common knowledge. *Erkenntnis*, *30*, 69–85.

Binmore, K. (2008). Do conventions need to be common knowledge? *Topoi*, *27*(1), 17–27.

Brandenburger, A. (1992). Knowledge and equilibrium in games. *The Journal of Economic Perspectives*, *6*(4), 83–101.

Brandenburger, A., & Dekel, E. (1989). The role of common knowledge assumptions in game theory. In F. Hahn (Ed.), *The economics of missing markets, information and games* (pp. 46–61). Oxford University Press.

Brandenburger, A., & Dekel, E. (1987). Common knowledge with probability 1. *Journal of Mathematical Economics*, *16*, 237–245.

Costa Werlang, S. R. (1989). *Game theory* (J. Eatwell, M. Milgate, & P. Newman, Eds.; pp. 74–85). Palgrave Macmillan UK.

Cubitt, R. P., & Sudgen, R. (2003). Common knowledge, salience and convention: A reconstruction of david lewis' game theory. *Economics and Philosophy*, *19*, 175–210.

Geanakoplos, J. (1994). Common knowledge. In R. J. Aumann & S. Hart (Eds.), *Handbook of game theory with economic applications* (1st ed., Vol. 2, pp. 1437–1496). Elsevier.

Geanakoplos, J., Pearce, D., & Stacchetti, E. (1989). Psychological games and sequential rationality. *Games and Economic Behaviour*, *1*, 60–79.

Harsanyi, J. C. (1973). Games with randomly disturbed payoffs: A new rationale for mixed-strategy equilibrium points. *International Journal of Game Theory*, *2*(1), 1–23.

Harsanyi, J. C. (1967). Games with incomplete information played by “bayesian” players, i-iii. Part i. The basic model. *Management Science*, *14*(3), 159–182.

Hintikka, J. (1962). *Knowledge and belief. An introduction to the logic of the two notions*. Cornell University Press.

Kreps, D. M., & Wilson, R. (1982). Sequential equilibria. *Econometrica*, *50*(4), 863–894.

Leibniz, G. W. (1710). *Essais de theodicée sur la bonté de dieu, la liberté de l’homme, et l’origine du mal*. David Mortier.

Lewis, D. K. (1969). *Convention. A philosophical study*. Harvard University Press.

Luce, R. D., & Raiffa, H. (1957). *Games and decisions - introduction and critical survey* (Seventh Printing). John Wiley & Sons, Inc.

Milgrom, P., & Roberts, J. (1991). Adaptive and sophisticated learning in normal form games. *Games and Economic Behavior*, *3*, 82–100.

Monderer, D., & Samet, D. (1989). Approximating common knowledge with common beliefs. *Games and Economic Behavior*, *1*, 170–190.

Nash, J. (1951). Non-cooperative games. *The Annals of Mathematics*, *54*(2), 286–295.

Nozick, R. (1963). *The normative theory of individual choice* [Dissertation]. Princeton University.

Osborne, M. J., & Rubinstein, A. (1994). *A course in game theory*. The MIT Press, Cambridge, Massachusetts.

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