

Fernando Macías

Computer Scientist, Post-doctoral Researcher, Ph.D.

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Fernando Macías is a post-doctoral researcher in the areas of Software Engineering and Computer Science. His work includes creative thinking, study of technical publications, tool prototyping and dissemination of research.

In recent years, Fernando has earned a PhD after extensive research, including the development of the open-source tool **MultEcore** and the publication of a PhD dissertation. More recently, he is involved in transferring research results regarding formal verification to both the aerospace industry and blockchain ecosystems.

Fernando holds a PhD in Informatics from the University of Oslo, Norway, and an MSc, Major and BSc from the University of Extremadura, Spain. He has lived in three countries and speaks English, Spanish and Norwegian.

Experience

- Post-doc Researcher**, IMDEA Software Institute, Madrid, Spain 2019–
Research on the state of the art and of the practice of embedded and distributed software systems, with special focus on test generation, model-based testing, symbolic execution, formal verification and blockchain monitoring.
- Part-time Lecturer**, Dep. of Information Systems Eng., University of Extremadura, Spain 2019
Teaching of the Bachelor course Concurrent and Distributed Programming (see **Teaching** below).
- R&D Engineer**, Homeria Open Solutions, Spain 2019
- Guest Researcher**, Dep. of Computer Science, Universidad Autónoma de Madrid, Spain 2017
Research on multi-level modelling.
- PhD Research Fellow**, Dep. of Software Engineering and Computing, Western Norway 2015–2019
University of Applied Sciences, Norway
75% research on formal aspects of model-driven engineering. Development of **MultEcore**, a framework for multi-level modelling and multilevel model transformation founded on graph theory and category theory. 25% teaching, carrying out lab sessions and evaluating in courses at the Master level.
- Lecturer**, EITIE Plan for Innovation and Entrepreneurship, University of Extremadura, Spain 2013
Teaching of the seminar Cloud-based Services for Software Development (see **Teaching** below).
- Research Fellow**, Quercus Software Engineering Group, University of Extremadura, Spain 2013–2015
Research on model-based reverse engineering of legacy web applications and its modernisation into rich internet applications using model-to-model transformation and code generation, and on model transformation verification using statistical methods.

Projects

- Offchain Tezos RV**, verification of high-level temporal properties on the Tezos blockchain 2022–
Funded by Nomadic Labs.
Researcher.
- MFoC**, techniques to improve the testing and verification of new-generation satellite systems 2019–2022
Co-funded project by Comunidad de Madrid and European Regional Development Fund (ERDF).
Main Researcher.
- MultEcore**, a tool for multilevel modelling and multilevel model transformation in EMF 2015–2019
Funded by the Western Norway University of Applied Sciences.
PhD Research Fellow.
- MLM Rearchitecting**, a tool for automatic rearchitecting of models into multilevel models 2017–2018
- RV+MM**, an approach to integrate runtime verification techniques into modelling processes 2016–2019
- DATASHELTER**, a system for microblog information retrieval with topic & sentiment analysis 2014–2015
Agreement with the company Nubalia Cloud Computing, S.L. Researcher.
- MoTES**, a model transformation testing approach based in contracts 2013–2021
- MIGRARIA**, a model-driven reverse engineering & modernisation process of legacy web apps 2013–2015
Co-funded by TIN2011-27340, GR-10129 and European Regional Development Fund (ERDF).
Researcher.

Management

Web Editor, I-MDE-A Workshop and MFoC Project and Workshop, IMDEA Software Institute, Spain 2019–

Student Union Member, Polytechnic School, University of Extremadura, Spain 2013–2014

Organisation

Organiser: [The I-MDE-A Workshop](#)

Organising Committee Member: [MFoC Workshop 2019](#), [NIKT 2016](#), [European Researcher's Night 2013](#)

Program Committee Member: [MULTI 2023](#), [MULTI 2022](#), [MULTI 2021](#), [MULTI 2020](#), [MULTI 2019](#)

Reviewer: [SoSyM](#), [EMISAJ](#), [IEEE Access](#), [MULTI 2023](#), [MULTI 2022](#), [MULTI 2021](#), [MULTI 2020](#), [MULTI 2019](#), [MULTI 2018](#), [NIKT 2016](#), [The 13th Overture Workshop \(2015\)](#)

Education

Philosophiae Doctor (PhD), Department of Informatics, University of Oslo, Norway 2019
Subject of the dissertation: [Multilevel Modelling and Domain Specific Languages](#).
Supervisors: [Adrian Rutle](#) and [Volker Stolz](#). Opponents: [Thomas Kühne](#) and [Reiko Heckel](#).

Master of Science (MSc), D. of Information Systems Eng., University of Extremadura, Spain 2014
Advanced curriculum in computer science and software engineering. Final mark 8,467/10. Master's research thesis distinction. Subject of the dissertation: Verification of Model-to-Model Transformations using Metrics. Supervisor: [Roberto Rodríguez Echeverría](#).

Science Major, Dep. of Information Systems Engineering, University of Extremadura, Spain 2013
Advanced curriculum in computer science and software engineering. Final mark 8,066/10. Ten-month Erasmus scholarship in the [Otto-Friedrich-Universität Bamberg](#), Germany. Senior research thesis distinction. Subject of the dissertation: Generating a RIA Client from a Legacy Web Application. Supervisor: [Roberto Rodríguez Echeverría](#).

Bachelor of Science (BSc), D. of Information Systems Eng., University of Extremadura, Spain 2011
General curriculum in computer science and software engineering.

Awards

Distinguished Student Award May 2015
Polytechnic School, University of Extremadura, Spain

Best Academic Record Award Software Engineering Master's Degree Feb 2015
Professional Association of Software Engineers of Extremadura, Spain

Best Academic Record Award Software Engineering Master's Degree Jan 2015
University of Extremadura, Spain

1st Prize in the category Health and Wellbeing at All Ages H4SB Hackaton Sep 2013
Campus Party Europe, London, United Kingdom

Best Non-verbal Communication Debate Team of the Polytechnic School Apr 2010
University of Extremadura, Spain

Educational Excellence Award Best academic record in Extremadura to matriculate for Nov 2008
Software Engineering
Savings Bank of Extremadura, Spain

Courses

ArVi Summer School on Runtime Verification, ArVi COST Action, Madrid, Spain Sep 2016

Erasmus+ Training Assignment, University of Lübeck, Lübeck, Germany May 2016

Communicating Scientific Research, Simula School of Research & Innovation, Oslo, Norway 2016

Developing Android Apps, Udacity, Online 2014

Introduction to Model-Driven Software Development, University of Extremadura, Spain 2013

Teaching

Lecturer and Lab Instructor, Concurrent and Distributed Programming (English and Spanish) Spring 2019
Bachelor course 501284, University of Extremadura

Lecturer and Lab Instructor , Advanced Software Technologies (English) Master course DAT250, Western Norway University of Applied Sciences	Fall 2018
Lecturer , Modern Software Development Methods (English) Master course DAT251, Western Norway University of Applied Sciences	Spring 2018
Lecturer and Lab Instructor , Advanced Software Technologies (English) Master course DAT250, Western Norway University of Applied Sciences	Fall 2017
Lecturer and Lab Instructor , Advanced Software Technologies (English) Master course DAT250 (former MOD250), Western Norway University of Applied Sciences	Fall 2016
Lecturer , Modern Software Development Methods (English) Master course DAT251 (former MOD251), Western Norway University of Applied Sciences	Spring 2016
Lecturer , Advanced Software Technologies (English) Master course DAT250 (former MOD250), Western Norway University of Applied Sciences	Fall 2015
Lecturer , Cloud-based tools for Software Developers (Spanish) EITIE training courses for entrepreneurship, University of Extremadura	Fall 2013

Supervision

Juan Francisco García Casado , Research Intern at IMDEA Software Institute and Master student in Formal Methods in Computer Science at Polytechnic University of Madrid. Master's thesis at Polytechnic University of Madrid. Subject of the dissertation: Property-based testing via guided and symbolic counterexample search. Final mark: 10/10.	2020–2023
Leif Arne R. Johnsen, Master student in Software Engineering at Western Norway University of Applied Sciences. Master's thesis at Western Norway University of Applied Sciences. Subject of the dissertation: Towards a multilevel model transformation engine.	2017
Gabor Stajer, Bachelor student in Computer Systems Networking and Telecommunications, Budapest University of Technology and Economics. IAESTE exchange student at Western Norway University of Applied Sciences.	2016
Rodrigo Vilaça, Bachelor student in Computer Engineering, University of Brasilia. IAESTE exchange student at Western Norway University of Applied Sciences.	2016

Computer skills

Software engineering: EMF, Eclipse, Java, C/C++, Go, Bash, SQL, HTML, CSS, JavaScript, XML, JSON

System administration: GNU/Linux, Android, macOS, MySQL, Subversion, Git

Collaborative tools: Slack, Mattermost, Trello, GDocs, Overleaf

Desktop publishing: L^AT_EX, Beamer, TikZ, BibTeX, Biber, Emacs, Microsoft Office, LibreOffice, Inkscape, GIMP

Languages

Mother tongue	Spanish									
Other languages ¹										
English²										
Norwegian (Bokmål)³										
	Understanding				Speaking				Writing	
	Listening		Reading		Interaction		Production			
	C2	Fluent	C2	Fluent	C2	Fluent	C2	Fluent	C2	Fluent
	A2	Basic	A2	Basic	A2	Basic	A2	Basic	A2	Basic

¹ Common European Framework of Reference for Languages (CEFR)

² Completed all courses at Official School of Languages in Badajoz, Spain

³ Tok A1 og A2 kurs på Folkeuniversitetet i Bergen

Publications

Peer-reviewed journals

- [1] Composition of multilevel domain-specific modelling languages
Alejandro Rodríguez, Fernando Macías, Francisco Durán, Adrian Rutle, Uwe Wolter
Journal of Logical and Algebraic Methods in Programming 130 (2023) p. 100831. 2023. DOI: [10.1016/j.jlamp.2022.100831](https://doi.org/10.1016/j.jlamp.2022.100831)
- [2] Multi-Level Modelling with MultEcore: A Contribution to the Multi-Level Process Challenge

Alejandro Rodríguez, Fernando Macías

Enterprise Modelling and Information Systems Architectures 17 (2022) pp. 1–40. 2022. doi: [10.18417/emisa.17.8](https://doi.org/10.18417/emisa.17.8)

- [3] Suggesting model transformation repairs for rule-based languages using a contract-based testing approach
Roberto Rodríguez-Echeverría, Fernando Macías, Adrian Rutle, José M Conejero
Software and Systems Modeling 21 (2021) pp. 81–112. Springer, 2021. doi: [10.1007/s10270-021-00891-0](https://doi.org/10.1007/s10270-021-00891-0)
- [4] Multilevel Coupled Model Transformations for Precise and Reusable Definition of Model Behaviour
Fernando Macías, Uwe Wolter, Adrian Rutle, Francisco Durán, Roberto Rodríguez-Echeverría
Journal of Logical and Algebraic Methods in Programming 106 (Aug. 2019) pp. 167–195. Elsevier, 2019. doi: [10.1016/j.jlamp.2018.12.005](https://doi.org/10.1016/j.jlamp.2018.12.005)
- [5] An Approach to Flexible Multilevel Modelling
Fernando Macías, Adrian Rutle, Volker Stolz, Roberto Rodríguez-Echeverría, Uwe Wolter
Enterprise Modelling and Information Systems Architectures 13 (2018) 10:1–10:35. 2018. doi: [10.18417/emisa.13.10](https://doi.org/10.18417/emisa.13.10)
- [6] Legacy Web Application Modernization by Generating a REST Service Layer
Roberto Rodríguez-Echeverría, Fernando Macías, Victor M. Pavón, José M. Conejero, Fernando Sánchez-Figueroa
IEEE Latin America Transactions 13 (July 2015) pp. 2379–2383. 2015. doi: [10.1109/TLA.2015.7273801](https://doi.org/10.1109/TLA.2015.7273801)

Peer-reviewed conferences and workshops

- [1] An application of KLEE to aerospace industrial software
Juan Francisco García, Daniel Jurjo, Fernando Macías, Jose F. Morales, Alessandra Gorla
XX Jornadas de Programación y Lenguajes (PROLE 2021), 2021
- [2] Multilevel Typed Graph Transformations
Uwe Wolter, Fernando Macías, Adrian Rutle
Graph Transformation, 2020. doi: [10.1007/978-3-030-51372-6_10](https://doi.org/10.1007/978-3-030-51372-6_10)
- [3] Composition of multilevel modelling hierarchies
Alejandro Rodríguez, Adrian Rutle, Francisco Durán, Lars Michael Kristensen, Fernando Macías, Uwe Wolter
Nordic Workshop on Programming Theory (NWPT), 2019. doi: [10.23658/taltech.nwpt/2019](https://doi.org/10.23658/taltech.nwpt/2019)
- [4] Multilevel Modelling with MultEcore: A Contribution to the MULTI Process Challenge
Alejandro Rodríguez, Fernando Macías
6th International Workshop on Multi-Level Modelling (MULTI 2019), 2019. doi: [10.1109/MODELS-C.2019.00026](https://doi.org/10.1109/MODELS-C.2019.00026)
- [5] Empowering Multilevel DSMLs with Integrated Runtime Verification
Fernando Macías, Adrian Rutle, Volker Stolz, Torben Scheffel, Malte Schmitz
Proceedings of the 3rd International Workshop on Verification of Objects at Runtime Execution (VORTEX 2019), 2019
- [6] Fuentes de Sobrecarga en Pruebas de Transformaciones de Modelos
Roberto Rodríguez-Echeverría, Fernando Macías, José M. Conejero, Juan C. Preciado, Alvaro E. Prieto, Adrian Rutle
Jornadas de Ingeniería del Software y Bases de Datos (JISBD), 2018
- [7] Multilevel modelling of coloured Petri nets
Alejandro Rodríguez, Adrian Rutle, Francisco Durán, Lars Michael, Fernando Macías
5th International Workshop on Multi-Level Modelling (MULTI 2018), 2018
- [8] A Tool for the Convergence of Multilevel Modelling Approaches
Fernando Macías, Adrian Rutle, Volker Stolz
5th International Workshop on Multi-Level Modelling (MULTI 2018), 2018
- [9] Towards Domain-Specific CPN Modelling Languages
Alejandro Rodríguez, Fernando Macías, Lars Michael Kristensen, Adrian Rutle
Nordic Workshop on Programming Theory (NWPT), 2017. ISBN: 978-952-12-3608-2
- [10] Towards an Autonomous Robot Architecture Combining Complex Event Processing and Multilevel Modelling
Juan Boubeta-Puig, Fernando Macías, Adrian Rutle
Nordic Workshop on Programming Theory (NWPT), 2017. ISBN: 978-952-12-3608-2
- [11] Coordination and Amalgamation of Multilevel Coupled Model Transformations
Fernando Macías, Adrian Rutle, Volker Stolz
Nordic Workshop on Programming Theory (NWPT), 2017. ISBN: 978-952-12-3608-2
- [12] Multilevel Modelling with MultEcore: A Contribution to the MULTI 2017 Challenge

Fernando Macías, Adrian Rutle, Volker Stolz

4th International Workshop on Multi-Level Modelling (MULTI 2017), 2017

- [13] Towards rearchitecting meta-models into multi-level models
Fernando Macías, Esther Guerra, Juan Lara
International Conference on Conceptual Modeling, 2017. DOI: [10.1007/978-3-319-69904-2_5](https://doi.org/10.1007/978-3-319-69904-2_5)
- [14] Describing Behaviour Models through Reusable, Multilevel, Coupled Model Transformations
Adrian Rutle, Fernando Macías, Francisco Durán, Roberto Rodríguez-Echeverría, Uwe Wolter
Nordic Workshop on Programming Theory (NWPT), 2016
- [15] Integration of Runtime Verification into Metamodeling
Fernando Macías, Torben Scheffel, Malte Schmitz, Rui Wang, Martin Leucker, Adrian Rutle, Volker Stolz
Nordic Workshop on Programming Theory (NWPT), 2016
- [16] Multilevel Behavioural Metamodelling
Fernando Macías, Adrian Rutle, Volker Stolz
Nordic Workshop on Programming Theory (NWPT), 2016
- [17] On Reducing Model Transformation Testing Overhead
Roberto Rodríguez-Echeverría, Fernando Macías, Adrian Rutle
2nd Joint International Workshop on Patterns in Model Engineering and the 5th International Workshop on the Verification of Model Transformation (PAME-VOLT 2016), 2016
- [18] MultEcore: Combining The Best of Fixed-Level and Multilevel Metamodelling
Fernando Macías, Adrian Rutle, Volker Stolz
3rd International Workshop on Multi-Level Modelling (MULTI 2016), 2016
- [19] Integration of Runtime Verification into Metamodeling for Simulation and Code Generation (Position Paper)
Fernando Macías, Torben Scheffel, Malte Schmitz, Rui Wang
16th International Conference in Runtime Verification (RV 2016), 2016. DOI: [10.1007/978-3-319-46982-9_29](https://doi.org/10.1007/978-3-319-46982-9_29)
- [20] A Heuristic Approach for Resolving the Class Responsibility Assignment Case
Maximiliano Vela, Yngve Lamo, Fazle Rabbi, Fernando Macías
9th Transformation Tool Contest (TTC 2016), 2016
- [21] A Property Specification Language for Runtime Verification of Executable Models
Fernando Macías, Adrian Rutle, Volker Stolz
Nordic Workshop on Programming Theory (NWPT), 2015
- [22] A statistical analysis approach to assist model transformation evolution
Roberto Rodríguez-Echeverría, Fernando Macías
MODELS, 2015. DOI: [10.1109/MODELS.2015.7338253](https://doi.org/10.1109/MODELS.2015.7338253)
- [23] Formalización de Modelos de Comportamiento
Fernando Macías
Jornadas de Concurrencia y Sistemas Distribuidos (JCSD), 2015
- [24] Herramienta de soporte en procesos de modernización, para las fases de ingeniería inversa y reestructuración
Víctor M. Pavón, Roberto Rodríguez-Echeverría, Fernando Macías, Pedro J. Clemente, Fernando Sánchez-Figueroa
Jornadas de Ingeniería del Software y Bases de Datos (JISBD), 2014. ISBN: 978-84-697-1152-1
- [25] Proceso de verificación de reglas de transformación basado en métricas
Fernando Macías, Roberto Rodríguez-Echeverría, Víctor M. Pavón, José M. Conejero, Fernando Sánchez-Figueroa
Jornadas de Ingeniería del Software y Bases de Datos (JISBD), 2014. ISBN: 978-84-697-1152-1
- [26] IFML-based model-driven front-end modernization
Roberto Rodríguez-Echeverría, Víctor M. Pavón, Fernando Macías, José M. Conejero, Pedro J. Clemente, Fernando Sánchez-Figueroa
Proceedings of the 23rd International Conference on Information Systems Development, (ISD 2014), 2014. ISBN: 978-953-6071-43-2
- [27] Generating a REST Service Layer from a Legacy System
Roberto Rodríguez-Echeverría, Fernando Macías, Víctor M. Pavón, José M. Conejero, Fernando Sánchez-Figueroa
Information System Development (2014) pp. 433–444. Springer International Publishing, 2014. DOI: [10.1007/978-3-319-07215-9_35](https://doi.org/10.1007/978-3-319-07215-9_35)
- [28] Generación dirigida por modelos de una API REST para una aplicación Web heredada

Fernando Macías, Víctor M. Pavón, Roberto Rodríguez-Echeverría, Fernando Sánchez-Figueroa
Jornadas de Ingeniería del Software y Bases de Datos (JISBD), 2013. ISBN: 978-84-695-8310-4

- [29] Model-driven generation of a REST API from a legacy web application
Roberto Rodríguez-Echeverría, Fernando Macías, Víctor M. Pavón, José M. Conejero, Fernando Sánchez-Figueroa
International Conference on Web Engineering, 2013. DOI: [10.1007/978-3-319-04244-2_13](https://doi.org/10.1007/978-3-319-04244-2_13)
- [30] Generating a Conceptual Representation of a Legacy Web Application
Roberto Rodríguez-Echeverría, Víctor M. Pavón, Fernando Macías, José M. Conejero, Pedro J. Clemente, Fernando Sánchez-Figueroa
International Conference on Web Information Systems Engineering, 2013. DOI: [10.1007/978-3-642-41154-0_17](https://doi.org/10.1007/978-3-642-41154-0_17)

Project deliverables and technical reports

- [1] Testing Embedded Software – State of the Art and State of the Practise
Fernando Macías, César Sánchez, Alessandra Gorla, José F. Morales
MFoC project deliverable, IMDEA Software Institute, 2020
- [2] The Category of Typing Chains as a Foundation of Multilevel Typed Model Transformations
Uwe Wolter, Fernando Macías, Adrian Rutle
Tech. rep., University of Bergen, Department of Informatics, 2019

Presentations

- [1] MFoC End-of-Project Report – Automatic V&V Techniques
[MFoC](#) End-of-Project Meeting, Madrid, Spain, 15 Jun 2022
- [2] MFoC Progress Report – Automatic V&V Techniques
[MFoC](#) Progress Meeting, Madrid, Spain, 18 Nov 2019
- [3] Multilevel Modelling and Domain-Specific Languages
[Software Seminar Series \(S3\)](#) at [IMDEA Software Institute](#), Madrid, Spain, 29 Oct 2019
- [4] Empowering Multilevel DSMLs with Integrated Runtime Verification
[VORTEX 2019](#), part of [ECOOP 2019](#), London, United Kingdom, 19 Jul 2019
- [5] Multilevel Modelling and Transformations with MultEcore and Multilevel Rearchitecting
[Southwest University](#), Chongqing, China, 20 Dec 2018
- [6] A Tool for the Convergence of Multilevel Modelling Approaches
[MULTI 2018](#), part of [MODELS 2018](#), Copenhagen, Denmark, 16 Oct 2018
- [7] Refactoring meta-models into multi-level models
[UFCG](#), Campina Grande, Brazil, 22 Nov 2017
- [8] Towards rearchitecting meta-models into multi-level models
[ER 2017](#), Valencia, Spain, 7 Nov 2017
- [9] Towards an Autonomous Robot Architecture Combining Complex Event Processing and Multilevel Modelling
NWPT 2017, Turku, Finland, 1 Nov 2017
- [10] Coordination and Amalgamation of Multilevel Coupled Model Transformations
NWPT 2017, Turku, Finland, 1 Nov 2017
- [11] Changing the way we program robots
Opening of the Computer Science PhD Programme at the [ICT Engineering Department](#), Bergen, Norway, 3 Oct 2017
- [12] Multilevel Modelling with MultEcore: A Contribution to the MULTI 2017 Challenge
[MULTI 2017](#), part of [MODELS 2017](#), Austin, Texas, USA, 19 Sep 2017
- [13] Multilevel Modelling with MultEcore
[University of Extremadura](#), Cáceres, Spain, 8 May 2017
- [14] Why I travelled over 2000 km to do a PhD
[ICT Engineering Department](#) Annual Seminar, Osterøy, Norway, 5 Apr 2017
- [15] Describing Behaviour Models through Reusable, Multilevel, Coupled Model Transformations
[NWPT 2016](#), North Jutland, Denmark, 1 Nov 2016

- [16] Multilevel Behavioural Metamodelling
NWPT 2016, North Jutland, Denmark, 1 Nov 2016
- [17] MultEcore: Combining The Best of Fixed-Level and Multilevel Metamodelling
MULTI 2016, part of MODELS 2016, Saint-Malo, France, 4 Oct 2016
- [18] On Reducing Model Transformation Testing Overhead
VOLT 2016, part of MODELS 2016, Saint-Malo, France, 2 Oct 2016
- [19] Solving the CRA problem with simulated annealing implemented in Java and ATL
TTC 2016, part of STAF 2016, Vienna, Austria, 8 Jul 2016
- [20] Runtime Verification of Executable Models
NWPT 2015, Reykjavík, Iceland, 22 Oct 2015
- [21] Formalización de Modelos de Comportamiento
JCSD 2015, Málaga, Spain, 11 Jun 2015
- [22] RSL: Revisión Sistemática de Literatura ó Reading Spooky Lots
University of Extremadura, Cáceres, Spain, 26 Sep 2014
- [23] Proceso de verificación de reglas de transformación basado en métricas
JISBD 2014, Cádiz, Spain, 17 Sep 2014
- [24] Herramienta de soporte en procesos de modernización, para las fases de ingeniería inversa y reestructuración
JISBD 2014, Cádiz, Spain, 17 Sep 2014
- [25] Generación dirigida por modelos de una API REST para una aplicación Web heredada
JISBD 2013, Madrid, Spain, 18 Sep 2013
- [26] Model-Driven Generation of a REST API from a Legacy Web Application
MDWE 2013, part of ICWE 2013, Aalborg, Denmark, 10 Jul 2013