



**ICT Call 7
ROBOHOW.COG
FP7-ICT-288533**

Deliverable D8.2:

**Report on Dissemination Activities and Plan for the Dissemination
of Knowledge**



January 31st, 2014

Project acronym: ROBOHOW.COG
Project full title: Web-enabled and Experience-based Cognitive Robots that Learn Complex Everyday Manipulation Tasks

Work Package: WP 8
Document number: D8.2
Document title: Report on Dissemination Activities and Plan for the Dissemination of Knowledge
Version: 1.0

Delivery date: January 31st, 2014
Nature: Report
Dissemination level: Public

Authors: Rodolphe Gelin (Aldebaran)
Moritz Tenorth (UniHB)

The research leading to these results has received funding from the European Union Seventh Framework Programme FP7/2007-2013 under grant agreement n^o288533 ROBOHOW.COG.

Contents

1	Report on Dissemination Activities	5
1.1	Dissemination material and project website	5
1.2	Dissemination to the scientific community	5
1.2.1	Prizes and Awards	5
1.2.2	Organized conference workshops	6
1.2.3	Contributions to summer schools	6
1.2.4	Invited plenary talks	6
1.2.5	Project publications	8
1.3	Dissemination to the industry	9
1.4	Dissemination to future users and the general public	10
1.4.1	Press reports (TV, radio, newspapers)	10
1.4.2	Demonstrations and public events	11
1.4.3	Dissemination to high-school students	11
1.5	Release of open-source software	12
2	Plan for the Dissemination of Knowledge	14
2.1	Dissemination material and project website	14
2.2	Dissemination to the scientific community	14
2.3	Dissemination to the industry	15
2.4	Dissemination to future users and the general public	15
2.5	Organization of summer schools on RoboHow	15
2.6	Release of open-source software	15
3	Project publications	17
3.1	Peer-reviewed publications	17
3.2	Accepted for publication	23
3.3	Submitted articles under review	23

Summary

During the two first years of the project, RoboHow has become well visible inside and outside the scientific community. A large number of publications has been published in journals and international conferences, and many invited talks and keynote speeches at major workshops and conferences have been given by the principal investigators in RoboHow. A booth at the Automatica trade fair in Munich in May 2012 gave the opportunity to present the concepts and vision of the project to an industrial audience. Widespread coverage in TV and print media informed the general public about the RoboHow idea of teaching robots novel tasks using information from the Internet. The comprehensive web infrastructure for internal and external communication has been set up, and a coherent layout for the web site, the project reports and other publications has been developed.

In the next period, the dissemination will become more intense and new workshops, papers and event are already planned.

Chapter 1

Report on Dissemination Activities

1.1 Dissemination material and project website

In Deliverable D8.1, we describe the web-based infrastructure set up for internal and external communication of the RoboHow project. This infrastructure includes a public web site for presenting the project to the scientific community, the general public, and to the press. It further consists of an internal section of the web site with a private wiki, a web-based project management and issue tracking software, a videoconferencing server, and several mailing lists for facilitating communication with and among the project members. Photos of the RoboHow robots as well as an information flyer and a poster can be downloaded.

1.2 Dissemination to the scientific community

Already in the first two years, the project consortium had strong dissemination to the scientific community by a large number of publications, several of which won or were nominated for awards. In addition, the partners organized a set of workshops and gave a large number of invited talks at conference and workshops.

1.2.1 Prizes and Awards

- First prize in CHALEARN gesture recognition competition (FORTH, 2013)
- Finalist for Best Cognitive Robotics Paper Award at IROS 2013 (KTH)
- Best Manipulation Paper Award at ICRA 2013 (KTH)
- Best Cognitive Robotics Paper Award at ICRA 2012 (UNIHB)
- Finalist for Best Service Robotics Paper Award at ICRA 2013 (UNIHB)
- Finalist for Best Paper Award at IROS 2012 (CNRS)
- Nikolaos Kyriazis, PhD student at FORTH working is the recipient of the “2012-2013 Young Researcher Award” of the University of Crete for his work within the RoboHow project

1.2.2 Organized conference workshops

- RSS 2013 workshop¹ on “Programming with constraints: Combining high-level action specification and low-level motion execution” (organized by KU Leuven and UniHB)
- IROS 2013 workshop² on AI-based Robotics (organized by UniHB)
- Robotics@KTH, a one-day workshop held at KTH on September 27th, with poster presentations of our scientific work and invited talks from 3 RoboHow PIs (Danica Kragic, Herman Bruyninckx, and Michael Beetz)

1.2.3 Contributions to summer schools

- Tutorial on “Robots and the Internet”³ at the LUCIA Winter School on “AI and Robotics”(Moritz Tenorth)
- International Summerschool on Agent-based Models of Creativity, Cortona (Italy), 16-20 September 2013
- Summer School on Computational Topology and Topological Data Analysis, Ljubljana, Slovenia, July 1st - July 4th 2013

1.2.4 Invited plenary talks

- Antonis Argyros, invited talk, Department of Engineering and Informatics, University of Siena, Italy, Jan. 23&24, 2012
- Michael Beetz, keynote speech, First EUCogIII Conference, February 23–24, Vienna
- Antonis Argyros, invited talk, Oxford Robotics Research Group, Oxford University, Oxford, UK, Mar. 26, 2012
- Michael Beetz, keynote speech, AAAI Spring Symposium on “Designing Intelligent Robots: Reintegrating AI”, March 26th–28th, Stanford University, USA
- Antonis Argyros, invited talk, The 30th Pattern Recognition and Computer Vision Colloquium, Center of Machine Perception, Czech Technical University of Prague, Czech Republic, Apr. 12, 2012
- Michael Beetz, invited talk, LCCC & ROSETTA Symposium on Robotic Skill Learning and Cognition, April 17–19, Lund, Sweden
- Michael Beetz, invited talk, Austrian Robotics Workshop, May 3–4, Graz, Austria
- Michael Beetz, invited talk, German-French Workshop: Perspectives on Cognitive Interaction and Technology, June 4–5, 2012, Bielefeld, Germany
- Antonis Argyros, keynote speech, The 5th International Conference on Pervasive Technologies Related to Assistive Environments (PETRA 2012), Hersonisos, Crete, Greece, June 6, 2012
- Michael Beetz, keynote speech, 12th International Conference on Intelligent Autonomous System (IAS-12), June 26–29, 2012, Jeju Island, Korea
- Antonis Argyros, invited talk, joint EU/US-NSF Workshop, Harvard University, Boston, 19-20 July 2012

¹<https://robohow.eu/meetings/rss-2013-constraints-workshop>

²<https://robohow.eu/workshops/ai-based-robotics-iros-2013>

³<http://aass.oru.se/Agora/Lucia2013/program.html>

- Danica Kragic, invited plenary speech at IFAC Symposium on Robot Control (SyRoCo), September 7, 2012, Dubrovnik, Croatia.
- Danica Kragic, invited session on “Mobile manipulation for household applications” at IFAC Symposium on Robot Control (SyRoCo), September 7, 2012, Dubrovnik, Croatia
- Danica Kragic, invited talk, “Vision for Action and Action for Vision”, at the Barcelona Cognition, Brain and Technology summer school (BCBT) Barcelona, Spain, Sept 11, 2012
- Michael Beetz, keynote speech, 3rd International Conference on Simulation, Modeling, and Programming for Autonomous Robots (SIMPAN), November 5–8, Tsukuba, Japan
- Antonis Argyros, invited talk, Department of Mechanical Engineering, Technological Educational Institute of Crete, December 6, 2012.
- Michael Beetz, invited talk, LUCIA workshop “AI meets robotics”, December 12–13, 2012 Örebro, Sweden
- The 2013 Multi-modal Gesture Recognition Challenge workshop, held in conjunction with ACM International Conference on Multimodal Interaction 2013, Sydney, Australia, Dec. 9, 2013.
- Università di Roma, La Sapienza, ALCOR Perception and Cognitive Robotics Lab., Nov. 11, 2013.
- Xperience summer school, Cala Millor, Castell de Mar, Majorca, Oct. 02 – 05, 2013.
- Keynote talk, IEEE International Symposium on Ubiquitous Virtual Reality (ISUVR 2013), KAIST, Daejeon, South Korea, Jun. 2013.
- Korean Institute of Science and Technology (KIST), Seoul, South Korea, Jun. 2013.
- Telluride Neuromorphic Cognition Engineering Workshop, workgroup on “Recognizing Manipulation Actions in Cluttered Environments from Vision and Sound”, Telluride, Colorado, USA, Jul. 2013.
- Workshop on New Open Source Tools for Robotics from EU Projects, EU Robotics Forum (ERF 2013), Lyon, 19-21 Mar. 2013.
- Kachergis, G., de Kleijn, R., and Hommel, B. A Spiking Neural Model for Sequential Action Control. 14th Annual Summer Interdisciplinary Conference, Cortina, Italy. 26 July 2013.
- Kachergis, G., Berends, F., de Kleijn, R., and Hommel, B. A novel trajectory serial reaction time paradigm. Nederlandse Vereniging voor Psychonomie [Meeting of the Dutch Psychonomics Society], Egmond aan Zee, Netherlands, 19 December 2013.
- M. Beetz, ICRA 2013 workshop on “Autonomous Learning”, Karlsruhe, 06. – 10.05.2013
- M. Beetz, “From Vague Instructions to Executable Robots Plans – Representation of, and Reasoning about, Action Verbs”, The Semantics of Action-Symposium, Göttingen, 10.06.2013
- M. Beetz, “Towards Robots that Know What They are doing: Reasoning about and Executing Complex Movements to Achieve the Desired Effects”, RSS 2013 workshop, Berlin, 28.06.2013
- M. Beetz, “Cognition-enabled Control of Robotic Agents”, SYDE, Kirchseele b. Stuhr, 15.08.2013
- M. Beetz, “If Abstraction is the Answer - What is the Question?”, Qualitative Reasoning Workshop, Schloss Etelsen, 27. – 30.08.2013
- M. Beetz, “Robotics Agents Performing Human-Scale Everyday Manipulation Tasks – In the Knowledge Lies the Power”, CITEC Summer School, Bielefeld, 11.09.2013

- M. Beetz, “Autonomous Learning for Bayesian Cognitive Robotics”, 2. Symposium Autonomous Learning, 23.09.2013
- M. Beetz, “Enhancing Human Action Recognition through Spatio-Temporal Feature Learning and Semantic Rules”, Humanoids 2013 Workshop, Atlanta (USA), 17.10.2013
- M. Beetz, “Constraint-Based Movement Representation Grounded in Geometric Features”, Humanoids 2013 Workshop, Atlanta (USA), 17.10.2013
- M. Beetz, “If Robot Action Planning Is the Answer – What is the Question?”, NSF-Workshop on Robot Planning, Arlington (USA), 29.10.2013
- M. Beetz, invited talk at “AI-based Robotics” workshop, IROS 2013, Tokyo, 07.11.2013
- M. Beetz, “Cognition-enabled Robot Control”, Lucia 2013, Örebro (Sweden), 13.12.2013
- M. Tenorth, “Web-enabled robots”, Lucia 2013, Örebro (Sweden), 13.12.2013

1.2.5 Project publications

The list of project publications of Year 1 and 2 can be found in Chapter 3.

1.3 Dissemination to the industry

The RoboHow project had a joint exhibition stand with the German CoTeSys Cluster of Excellence, coordinated by former RoboHow partner TUM, at the Automatica trade fair in Munich, the world's largest trade fair on robotics and automation. While the RoboHow integrated architecture has not yet been established, we could present the PR2 robot making popcorn for the visitors using an earlier software version. This public demonstration attracted many visitors and gave us the opportunity to explain the objectives and approaches of the RoboHow project to a wide audience.



Figure 1.1: PR2 robot preparing popcorn for the visitors of the Automatica fair in Munich (joint booth with the CoTeSys Cluster of Excellence).

First contacts to potential industrial users outside of the consortium have been established: UniHB has started a collaboration with PAL Robotics, the developer of the REEM robots⁴, regarding the use of the CRAM plan-based control system. First tests have been successful, and PAL continues to work on the integration. As REEM's control framework is based on the Stack of Tasks (WP3), significant parts of the RoboHow software stack may be running on that robot.

During a visit of the Bremen Chamber of Commerce, UniHB has demonstrated the RoboHow robots and explained the core ideas of the project. Bernhard Hommel (UL) has presented the project as part of the talk "How smart are robots?" in front of the Kamer van koophandel (Chamber of Commerce) in Den Haag.

FORTH's 3D hand tracking software was demonstrated at CVPR 2013 at the booth of OpenNI, Jun. 2013. FORTH also participated in the International Exhibition of Thessaloniki, the biggest trade fair in Greece, showcasing the FORTH 3D hand tracking software, in Sep. 2013.

⁴<http://pal-robotics.com/robots>

1.4 Dissemination to future users and the general public

In addition to scientific publications, the RoboHow partners have communicated the ideas and results of the project to the general public in terms of press releases, interviews, public demonstrations and by creating teaching material for high-school students from the research results.

1.4.1 Press reports (TV, radio, newspapers)

An up-to-date report on the media coverage on RoboHow can be found on the website⁵. A press day at UniHB in Spring 2013 has resulted in a considerable number of reports in German and international media:

- 4 TV reports (ZDF, NTDTV, RadioBremen, SAT1)
- 2 radio interviews (Deutschlandradio Kultur, SWR)
- More than 20 newspaper articles, including news distributed via the DPA press agency

In addition, other reports have been published: On January 7th, 2013, Danica Kragic talked about development of domestic robot technology as an invited guest in the show “Gomorrnon Sverige” on Swedish Public Television, SVT. On February 9th, 2013, a major Greek newspaper (Kathimerini) hosted an interview of Antonis Argyros, regarding the 3D tracking framework developed at FORTH, with a special mention to the RoboHow project.



Figure 1.2: Left: PR2 flipping pancakes using the RoboHow controllers during the press meeting. Right: Coverage in the nation-wide evening news at ZDF, one of the two main public TV stations in Germany.

⁵<https://robohow.eu/media/coverage>

1.4.2 Demonstrations and public events

- Open day at UNIHB including the PR2 Robot demonstrating RoboHow tasks
- Utopiales (science fiction festival), Nantes, France, November 2012: Meet Nao by Aldebaran Robotics
- Presentation of the RoboHow project at the 50-year anniversary celebration of the CS department at KTH
- ICT conference in Vilnius, Lituania, November 2013: Workshop on Start Up and SME's with Aldebaran Robotics
- Fete de la Science, Chantilly, France, October 2013: Living with a humanoid robot by Aldebaran Robotics
- Talk: "In love with a robot" at the Night of art and science in Leiden by Bernhard Hommel and Roy de Kleijn, September 2013.

1.4.3 Dissemination to high-school students

The **TUM@School.School@TUM**⁶ is an initiative by the TUM School of Education to bring complex leading-edge research topics into German highschools. Since those topics often are difficult to grasp even for the teaching staff in schools, the goal of this project is to process and represent research results from university researchers in an easy, didactically illustrative way such that the topics become easier to understand for junior and senior high-school students. To this end, the work by [43] on Probabilistic Robot Action Cores (PRAC) for natural-language interpretation and completion, which has been conducted within the RoboHow project, has been selected to be brought into high-school classes. The scientific RoboHow paper has been adapted by the TUM School of Education for high-school teaching material (Figure 1.3).

FORTH has presented its research at the Pancrition high school in Heraklion, Crete on Mar. 6, 2013.

WELCHE PROBLEME TRETEN AUF, WENN EIN ROBOTER IN MENSCHLICHEN BEREICHEN HANDELT UND ANWEISUNGEN INTERPRETIERT?

1. Begriffserklärung:

„Pfanne“ = 

Dem Roboter fehlen die Hintergrundinformationen, die den Menschen bei lebensnahen Handlungen vollkommen klar sind.

2. Beenden einer Tätigkeit:

„Der Kuchen ist fertig...
und nun?“ 



Roboter brauchen die Fähigkeit, Erklärungen, die Menschen geben, zu verstehen.



Figure 1.3: Excerpt of the highschool teaching material on Probabilistic Robot Action Cores (PRAC).

⁶<http://www.hall.edu.tum.de/index.php?id=45&L=1>

1.5 Release of open-source software

The RoboHow partners have already released several of the core components of the project as open-source code or free-to-use binary libraries. While some software components have been released prior to the project, we will integrate the software developed in RoboHow and further maintain these packages that often already have an active user community.

The development concerned

- **WP1** developed methods for learning action-specific knowledge bases that allow completing underspecified instructions, and elaborated on representation formats for the various kinds of knowledge in the system.
- **WP2** created a framework capable of tracking a human's hands as well as the objects they interact with. An instantiation of this framework has won a tracking competition and has been released as a standalone demo and a free for non-commercial use library.
- **WP3** worked on the one hand on the integration of the two control frameworks, the Stack of Tasks and iTaSC, to progress towards one integrated constraint- and optimization-based control architecture and on the other hand on the integration of the high level planning language CRAM and iTaSC.
- **WP4** studied in particular tool calibration, an important aspect for goal-directed object interaction, and the interplay between perception and control methods.
- **WP5** investigated methods for bootstrapping imitation learning and started to explore how the learned models can be represented in terms of the constraints needed by the control framework.
- **WP6** progressed in two directions: On the one hand towards controlling more complex mobile manipulation tasks from the CRAM system, on the other hand towards a better integration with the constraint-based controllers for motion execution.

The following software packages have been released and are available on <https://www.robohow.eu/software> and <https://github.com/RoboHow>.

3D hand tracking library This library by partner FORTH tracks the 3D position, orientation and full articulation of a human hand from marker-less visual observations. It estimates the full articulation of a hand in unconstrained motions using RGB-D cameras without markers at a rate of 20fps in modern architectures. The FORTH 3D Hand Tracking library is available with a free license for non-commercial use for MS Windows and Linux operating systems.

URL: <http://www.openni.org/files/3d-hand-tracking-library>

CRAM The CRAM plan language is the core of the CRAM framework and provides the basic functionality to write flexible and robust robot control programs. In RoboHow, CRAM is being extended towards executing motions specified in terms of constraints on the constraint- and optimization-based control framework. URL: http://www.ros.org/wiki/cram_core

iTASC iTaSC (instantaneous Task Specification using Constraints) is a framework to generate robot motions by specifying constraints between (parts of) the robots and their environment. iTaSC was born as a specification formalisms to generalize and extend existing approaches, such as the Operational Space Approach, the Task Function Approach, the Task Frame Formalism,

geometric Cartesian Space control, and Joint Space control. URL: <http://www.orocos.org/wiki/orocos/itasc-wiki>

KnowRob is a knowledge processing system that combines knowledge representation and reasoning methods with techniques for acquiring knowledge from different sources and for grounding the knowledge in a physical system. It became the main knowledge base in the ROS ecosystem and is actively being used in different labs and for several EU projects (e.g. RoboEarth, SRS, Sherpa, ACAT). URL: <http://www.knowrob.org>

PARMA The “Physics-aware Robot Manipulation” package provides tools that help robots to infer the consequences of their parameterized manipulation actions in order to make competent and failure-aware decisions during their course of action. It allows asking queries using a first-order language that are answered based on detailed physics-based simulations of parameterized robot control programs. URL: <http://ias.cs.tum.edu/~kunzel/parma>

Semantic relations checking The goal of the geometric relations semantics is to provide semantic checking for calculations with geometric relations between rigid bodies on top of existing geometric libraries, which are only working on specific coordinate representations. Since there are already a lot of libraries with good support for geometric calculations on specific coordinate representations, we do not want to design yet another library but rather will extend these existing geometric libraries with semantic support. URL: <http://www.orocos.org/wiki/geometric-relations-semantics-wiki>

Chapter 2

Plan for the Dissemination of Knowledge

During the third year of the RoboHow project, we plan to continue our successful dissemination strategy. All members of the consortium publish their research results in the top scientific journals and conferences, actively organize RoboHow-related conference workshops, and present the ideas during invited talks and at events for the general public. A particular focus of the project is on complementing the scientific papers with open-source libraries that allow other researchers to use and build upon the results. In the following, we outline our plans for the following year.

2.1 Dissemination material and project website

The website of the project <http://robohow.eu/> will be permanently updated with a complete information set on RoboHow including press kit, leaflets/generic posters for events, and a collection of up-to-date visual material. The blog on the front page of the website informs about events organized by RoboHow, current publications or research accomplishments.

2.2 Dissemination to the scientific community

All partners are regularly publishing their research results in the leading conferences and journals in the field. In Year 3, we plan to increase the number of cross-partner and cross-workpackage publications. We expect several publications to result from the work towards an integrated robotic system and from the joint experiments performed in preparation of the Year 2 review. In addition, we are currently preparing a RoboHow journal paper that gives an overview of the concepts and methods used in the project.

At AAAI 2014, Moritz Tenorth from UniHB will co-organize a workshop on "AI and Robotics"¹ that will include developments of RoboHow. As the project is naturally at the intersection of research in AI and robotics, several members are actively involved in current efforts towards a re-integration of these two research areas; this workshop is part of this effort.

¹<http://aass.oru.se/Agora/AIRob2014/>

Currently, Gianni Borghesan (KUL), Torsten Kroeger (Stanford University), and Andrea Maria Zanchettin (Politecnico di Milano), are preparing a workshop proposal to be submitted to IROS 2014 committee, with the tentative title: "Constraint-based real-time motion generation". The workshop topics covers control and plan aspects that are investigated by KUL and CNRS RoboHow partners.

2.3 Dissemination to the industry

Aldebaran will organize a workshop during a major robotic event about the potential industrial applications of the results of the project. INNOROBO (<http://www.innorobo.com/en/>) could be a good place for this because this event gathers the industrial and the academic community.

2.4 Dissemination to future users and the general public

Integrated robot experiments will become more and more important in the second half of the project. Such experiments often result in impressive videos that convey the ideas of the project to the general public. We plan to continue disseminating the videos via the RoboHow YouTube channel. In the past, similar videos of robots performing household tasks received a lot of attention and got tens of thousand views². As before, we also plan to show the robot demonstrations during public events such as the Open Day of the university.

Romeo will be finally available and its presentation to the public will generate a lot of papers and reports in which RoboHow will be mentioned.

2.5 Organization of summer schools on RoboHow

A summer school on the RoboHow tickets is currently planned for Fall 2014. A successful summer school requires some time to prepare the topic and to invite a set of high-quality speakers. Having the school in the second half of the project will also allow to better demonstrate the benefits of the RoboHow approach in an integrated robotic system.

2.6 Release of open-source software

RoboHow follows an open-source strategy, aiming at releasing documented software libraries in addition to scientific publications. Several partners have already released software packages that are among the leading open-source libraries in their respective domains. We will continue in this direction and in particular plan the release of the following libraries and data sets in the following year:

KnowRob As part of the KnowRob knowledge base, we plan to release the following new packages during the year: In WP1, we have developed techniques for automatically creating geometric-semantic models of functional object parts from CAD models [65]. This library will be released, possibly in conjunction with a dataset of 3D models (depending on license issues). In addition,

²<http://www.youtube.com/user/iasTUMUNICH/videos>

we will release and document the representations and inference methods for motion constraints that have been developed as joint project between the workpackages 1, 3 and 6.

CRAM As part of RoboHow, the CRAM plan language has been extended with novel language elements and control structures that will be included into the next release. The interface between the constraint- and optimization-based control framework of WP3 and the plan-based controller of WP 6 will also be included.

We further plan to release the plans for generalized pick and place actions that have been developed in WP6. On the one hand, we expect them to be useful for external parties that would like to create mobile manipulation tasks on the PR2 or similar robots, but on the other hand they can also serve as example how complex behavior can be implemented using the language.

A final component to be released is the system for recording structured log data of robot plan executions [71]. This system can be used for recording log data for evaluating the robot's behavior as well as for building structured databases for learning predictive models.

Datasets Besides program code, we also expect collected data sets to be useful to other parties. In the following year, we plan to make a data set of logged experiences of long-term pick-and-place activities available to the community that has been recorded using the system described in [71].

In addition, the annotated data set of action verbs and their roles in actions that has been collected from instructions on *wikihow.com* and annotated by Amazon Mechanical Turk will be made available. The data has been described in [43].

Chapter 3

Project publications

3.1 Peer-reviewed publications

- [1] Don Joven Agravante, Andrea Cherubini, Antoine Bussy, and Abderrahmane Kheddar. Human-Humanoid Joint Haptic Table Carrying Task with Height Stabilization using Vision. In *IROS'13: International Conference on Robots and Intelligent Systems*, page N/A, Tokyo, Japan, November 2013.
- [2] Don Joven Agravante, Andrea Cherubini, and Abderrahmane Kheddar. Using vision and haptic sensing for human-humanoid haptic joint actions. In *CISRAM'13: Cybernetics and Intelligent Systems Robotics, Automation and Mechatronics*, page 6, Manila, Philippines, November 2013.
- [3] Georg Bartels, Ingo Kresse, and Michael Beetz. Constraint-based movement representation grounded in geometric features. In *Proceedings of the IEEE-RAS International Conference on Humanoid Robots*, Atlanta, Georgia, USA, October 15–17 2013.
- [4] Michael Beetz, Dominik Jain, Lorenz Mösenlechner, Moritz Tenorth, Lars Kunze, Nico Blodow, and Dejan Pangercic. Cognition-enabled autonomous robot control for the realization of home chore task intelligence. *Proceedings of the IEEE*, 100(8):2454–2471, 2012.
- [5] Michael Beetz, Lorenz Mösenlechner, Moritz Tenorth, and Thomas Rühr. Cram – a cognitive robot abstract machine. In *5th International Conference on Cognitive Systems (CogSys 2012)*, 2012.
- [6] Michael Beetz, Moritz Tenorth, Dejan Pangercic, and Benjamin Pitzer. Semantic object maps for household tasks. In *5th International Conference on Cognitive Systems (CogSys 2012)*, 2012.
- [7] Yasemin Bekiroglu, Dan Song, Lu Wang, and Danica Kragic. A probabilistic framework for task-oriented grasp stability assessment. In *Robotics and Automation (ICRA), 2013 IEEE International Conference on*, pages 3040–3047, 2013.
- [8] F. Berends, G. Kachergis, R. de Kleijn, and B. Hommel. A novel trajectory serial reaction time paradigm. In *NVP Winter Conference*, Egmond aan Zee, Netherlands, 2013.

- [9] Mårten Björkman, Yasemin Bekiroğlu, Virgile Högman, and Danica Kragic. Enhancing visual perception of shape through tactile glances. In *IEEE/RSJ International Conference on Intelligent Robots and Systems*, pages 3180–3186, 2013.
- [10] Gianni Borghesan, Bert Willaert, and Tinne De Laet. Teleoperation in Presence of Uncertainties : a Constraint-Based Approach. In *Proc. of 10th IFAC Symposium on Robot Control*, pages 385–392, 2012.
- [11] Karim Bouyarmane and Abderahmanne Kheddar. On the dynamics modeling of free-floating-base articulated mechanisms and applications to humanoid whole-body dynamics and control. In *IEEE-RAS Int. Conf. on Humanoid Robots (Humanoids'12)*, volume 1, pages 036–042, Osaka, Japan, December 2012.
- [12] Karim Bouyarmane, Joris Vaillant, François Keith, and Abderahmanne Kheddar. Exploring humanoid robot locomotion capabilities in virtual disaster response scenarios. In *IEEE-RAS Int. Conf. on Humanoid Robots (Humanoids'12)*, volume 1, pages 337–342, Osaka, Japan, December 2012.
- [13] Karim Bouyarmane, Joris Vaillant, and Jun Morimoto. Low-Dimensional User Control of Autonomously Planned Whole-Body Humanoid Locomotion Motion Towards Brain-Computer Interface Applications. In *CLAWAR'13: International Conference on Climbing and Walking Robots*, page 9, Sydney, Australia, July 2013.
- [14] Karim Bouyarmane, Joris Vaillant, Norikazu Sugimoto, François Keith, Jun-Ichiro Furukawa, and Jun Morimoto. BCI Control of Whole-body Simulated Humanoid by Combining Motor Imagery Detection and Autonomous Motion Planning. In *ICONIP'13: International Conference on Neural Information Processing*, page 9, Daegu, Corée, République De, November 2013.
- [15] Stanislas Brossette, Joris Vaillant, François Keith, Adrien Escande, and Abderrahmane Kheddar. Point-Cloud Multi-Contact Planning for Humanoids: Preliminary Results. In *CISRAM'13: Cybernetics and Intelligent Systems Robotics, Automation and Mechatronics*, volume 1, page 6, Manila & Pico de Loro Beach, Philippines, November 2013.
- [16] A. Bussy, P. Gergondet, A. Kheddar, F. Keith, and A. Crosnier. Proactive behavior of a humanoid robot in a haptic transportation task with a human partner. In *Ro-Man'2012: International Symposium on Robot and Human Interactive Communication*, pages 962–967, Université de Versaille, France, September 2012. IEEE/RSJ.
- [17] Antoine Bussy, Abderrahmane Kheddar, André Crosnier, and François Keith. Human-humanoid haptic joint object transportation case study. In *IROS'12: International Conference on Intelligent Robots and Systems*, volume 1, pages 3633–3638, Vilamoura, Algarve, Portugal, October 2012.
- [18] Tinne De Laet, Steven Bellens, Herman Bruyninckx, and Joris De Schutter. Geometric Relations between Rigid Bodies (Part 2) From Semantics to Software. *IEEE Robotics & Automation Magazine*, 2012.
- [19] Xavi Gratal, Javier Romero, Jeannette Bohg, and Danica Kragic. Visual servoing on unknown objects. *Mechatronics*, 22(4):423–435, 2012.

- [20] Xavi Gratal, Christian Smith, Mårten Björkman, and Danica Kragic. Integrating 3d features and virtual visual servoing for hand-eye and humanoid robot pose estimation. In *IEEE-RAS International Conference on Humanoid Robots*, pages 240–245, 2013.
- [21] Karol Hausman, Ferenc Balint-Benczedi, Dejan Pangercic, Zoltan-Csaba Marton, Ryohei Ueda, Kei Okada, and Michael Beetz. Tracking-based interactive segmentation of textureless objects. In *IEEE International Conference on Robotics and Automation (ICRA)*, Karlsruhe, Germany, May 6–10 2013.
- [22] Bernhard Hommel. Dancing in the dark: No role for consciousness in action control. *Frontiers in Psychology*, 4(380), 2013.
- [23] Bernhard Hommel. Ideomotor action control: on the perceptual grounding of voluntary actions and agents. *Action science: Foundations of an emerging discipline*, pages 113–136, 2013.
- [24] Bidan Huang, S. El-Khoury, Miao Li, Joanna J. Bryson, and A. Billard. Learning a real time grasping strategy. In *IEEE International Conference on Robotics and Automation (ICRA)*, 2013.
- [25] Charmayne Mary Lee Hughes, Moritz Tenorth, Marta Bienkiewicz, and Joachim Hermsdörfer. Action sequencing and error production in stroke patients with apraxia – Behavioral modeling using Bayesian Logic Networks. In *6th International Conference on Health Informatics (HEALTHINF 2013)*, Barcelona, Spain, February 11–14 2013.
- [26] G. Kachergis, R. de Kleijn, and B. Hommel. A spiking neural model for sequential action control. In *14th Annual Summer Interdisciplinary Conference*, Cortina, Italy, 2013.
- [27] Yiannis Karayiannidis, Christian Smith, Petter Ögren, and Danica Kragic. Adaptive force/velocity control for opening unknown doors. In *International IFAC Symposium on Robotic Control*, 2012.
- [28] Yiannis Karayiannidis, Christian Smith, Francisco Vina, and Danica Kragic. Online kinematics estimation for active human-robot manipulation of jointly held objects. In *IEEE/RSJ International Conference on Intelligent Robots and Systems*, pages 4872–4878, 2013.
- [29] Yiannis Karayiannidis, Christian Smith, Francisco Vina, Petter Ögren, and Danica Kragic. Design of force-driven online motion plans for door opening under uncertainties. In *IEEE/RSJ International Conference on Intelligent Robots and Systems, Workshop on Real-time Motion Planning: Online, Reactive, and in Real-time*, 2012.
- [30] Yiannis Karayiannidis, Christian Smith, Francisco Vina, Petter Ögren, and Danica Kragic. "open sesame!" - adaptive force/velocity control for opening unknown doors. In *IEEE/RSJ International Conference on Intelligent Robots and Systems*, pages 4040–4047, 2012.
- [31] Yiannis Karayiannidis, Christian Smith, Francisco Vina, Petter Ögren, and Danica Kragic. Interactive perception and manipulation of unknown constrained mechanisms using adaptive control. In *Mobile Manipulation Workshop on Interactive Perception, IEEE International Conference on Robotics and Automation*, 2013.

- [32] Yiannis Karayiannidis, Christian Smith, Francisco Vina, Petter Ögren, and Danica Kragic. Model-free robot manipulation of doors and drawers by means of fixed-grasps. In *IEEE International Conference on Robotics and Automation (ICRA)*, 2013.
- [33] S. El Khoury, Miao Li, and A. Billard. Bridging the gap: One shot grasp synthesis approach. In *IEEE/RSJ International Conference on Intelligent Robots and Systems*, pages 2027–2034, 2012.
- [34] Reinhard Klapfer, Lars Kunze, and Michael Beetz. Pouring and Mixing Liquids — Understanding the Physical Effects of Everyday Robot Manipulation Actions. In *35th German Conference on Artificial Intelligence (KI-2012), Workshop on Human Reasoning and Automated Deduction*, Saarbrücken, Germany, September 24–27 2012.
- [35] Reinhard Klapfer, Lars Kunze, and Michael Beetz. Pouring and mixing liquids – understanding the physical effects of everyday robot manipulation actions. *Human Reasoning and Automated Deduction*, 2012.
- [36] Ingo Kresse and Michael Beetz. Movement-aware action control – integrating symbolic and control-theoretic action execution. In *IEEE International Conference on Robotics and Automation (ICRA)*, St. Paul, MN, USA, May 14–18 2012.
- [37] Lars Kunze, Andrei Haidu, and Michael Beetz. Making Virtual Pancakes — Acquiring and Analyzing Data of Everyday Manipulation Tasks through Interactive Physics-based Simulations. In *Poster and Demo Track of the 35th German Conference on Artificial Intelligence (KI-2012)*, Saarbrücken, Germany, September 24–27 2012.
- [38] N. Kyriazis and A.A. Argyros. Physically plausible 3d scene tracking: The single actor hypothesis. In *IEEE Conference on Computer Vision and Pattern Recognition (CVPR 2013)*, 2013.
- [39] S. Lengagne, J. Vaillant, A. Kheddar, and E. Yoshida. Generation of whole-body optimal dynamic multi-contact motions. *International Journal of Robotics Research*, 2013.
- [40] Johan Markdahl, Yiannis Karayiannidis, and Xiaoming Hu. Cooperative object path following control by means of mobile manipulators: a switched systems approach. In *International IFAC Symposium on Robotic Control*, pages 846–851, Dubrovnik, Croatia, sep 2012.
- [41] Zoltan-Csaba Marton, Ferenc Balint-Benczedi, Oscar Martinez Mozos, Dejan Pangercic, and Michael Beetz. Incremental object categorization in clutter. In *2nd Workshop on Robots in Clutter, in conjunction with RSS2013*, Berlin, Germany, June 27 2013.
- [42] Lorenz Mösenlechner and Michael Beetz. Fast temporal projection using accurate physics-based geometric reasoning. In *IEEE International Conference on Robotics and Automation (ICRA)*, Karlsruhe, Germany, May 6–10 2013.
- [43] Daniel Nyga and Michael Beetz. Everything robots always wanted to know about housework (but were afraid to ask). In *2012 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, Vilamoura, Portugal, October, 7–12 2012.
- [44] Petter Ögren, Christian Smith, Yiannis Karayiannidis, and Danica Kragic. A multi objective control approach to online dual arm manipulation. In *International IFAC Symposium on Robotic Control*, 2012.

- [45] I. Oikonomidis, N. Kyriazis, and A. Argyros. Tracking the articulated motion of human hands in 3d. *ERCIM News*, 2013(95), 2013.
- [46] I. Oikonomidis, N. Kyriazis, and A.A. Argyros. Tracking the articulated motion of two strongly interacting hands. In *IEEE Conference on Computer Vision and Pattern Recognition (CVPR 2012)*, pages 1862–1869. IEEE, 2012.
- [47] I. Oikonomidis, N. Kyriazis, K. Tzevanidis, and A.A. Argyros. Tracking hand articulations: Relying on 3d visual hulls versus relying on multiple 2d cues. In *Proceedings of the IEEE International Symposium on Ubiquitous Virtual Reality 2013 (ISUVR 2013)*, July 2013.
- [48] A.L. Pais, A. Billard, B. Robins, and K. Dautenhahn. Improving human-robot interaction through facial expressions of emotion and touch detection. In *CogSys, International Conference on Cognitive Systems*, Vienna, Austria, 2012.
- [49] Ana L. Pais and Aude Billard. Tactile interface user-friendliness evaluated in the context of robot programming by demonstration. In *Workshop on Advances in Tactile Sensing and Touch based HRI, HRI '12*, 2012.
- [50] Lucia Pais, Keisuke Umezawa, Yoshihiko Nakamura, and Aude Billard. Learning robot skills through motion segmentation and constraints extraction. In *Workshop on Collaborative Manipulation, ACM/IEEE International Conference on Human Robot Interaction HRI 2013*, 2013.
- [51] Dejan Pangercic, Moritz Tenorth, Benjamin Pitzer, and Michael Beetz. Semantic object maps for robotic housework - representation, acquisition and use. In *2012 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, Vilamoura, Portugal, October, 7–12 2012.
- [52] Konstantinos E. Papoutsakis and Antonis A. Argyros. Integrating tracking with fine object segmentation. *Image and Vision Computing*, 31(10):771 – 785, 2013.
- [53] Mitesh Patel, Carl Henrik Ek, Nikolaos Kyriazis, Antonis A. Argyros, Jaime Valls Miro, and Danica Kragic. Language for learning complex human-object interactions. In *IEEE International Conference of Robotics and Automation (ICRA 2013)*, 2013.
- [54] Eric L. Sauser, Brenna D. Argall, Giorgio Metta, and Aude G. Billard. Iterative learning of grasp adaptation through human corrections. *Robot. Auton. Syst.*, 60:55–71, January 2012.
- [55] Christian Smith and Yiannis Karayiannidis. Optimal command ordering for serial link manipulators. In *IEEE-RAS International Conference on Humanoid Robots*, pages 255–261, 2012.
- [56] Christian Smith, Yiannis Karayiannidis, Lazaros Nalpantidis, Xavi Gratal, Peng Qi, Dimos V. Dimarogonas, and Danica Kragic. Dual arm manipulation—a survey. *Robotics and Autonomous Systems*, 60(10):1340 – 1353, 2012.
- [57] Dan Song, Nikolaos Kyriazis, Iason Oikonomidis, Chavdar Papazov, Antonis Argyros, Darius Burschka, and Danica Kragic. Predicting human intention in visual observations of hand/object interactions. In *IEEE International Conference on Robotics and Automation*, 2013.

- [58] Moritz Tenorth and Michael Beetz. Knowledge processing for autonomous robot control. In *AAAI Spring Symposium on Designing Intelligent Robots: Reintegrating AI*, Stanford, CA, USA, March 26–28 2012.
- [59] Moritz Tenorth and Michael Beetz. A unified representation for reasoning about robot actions, processes, and their effects on objects. In *2012 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, Vilamoura, Portugal, October, 7–12 2012.
- [60] Moritz Tenorth and Michael Beetz. KnowRob – A Knowledge Processing Infrastructure for Cognition-enabled Robots. *International Journal of Robotics Research (IJRR)*, 32(5):566 – 590, April 2013.
- [61] Moritz Tenorth, Koji Kamei, Satoru Satake, Takahiro Miyashita, and Norihiro Hagita. Building knowledge-enabled cloud robotics applications using the ubiquitous network robot platform. In *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, Tokyo Big Sight, Japan, November 3–7 2013.
- [62] Moritz Tenorth, Fernando De la Torre, and Michael Beetz. Learning probability distributions over partially-ordered human everyday activities. In *IEEE International Conference on Robotics and Automation (ICRA)*, Karlsruhe, Germany, May 6–10 2013.
- [63] Moritz Tenorth, Alexander Clifford Perzylo, Reinhard Lafrenz, and Michael Beetz. Representation and Exchange of Knowledge about Actions, Objects, and Environments in the RoboEarth Framework. *IEEE Transactions on Automation Science and Engineering (T-ASE)*, 10(3):643–651, 2013.
- [64] Moritz Tenorth, Alexander Clifford Perzylo, Reinhard Lafrenz, and Michael Beetz. The roboearth language: Representing and exchanging knowledge about actions, objects, and environments (extended abstract). In *23rd International Joint Conference on Artificial Intelligence (IJCAI 2013). Special track on Best Papers in Sister Conferences*, Beijing, China, August 3–9 2013. Invited paper.
- [65] Moritz Tenorth, Stefan Profanter, Ferenc Balint-Benczedi, and Michael Beetz. Decomposing cad models of objects of daily use and reasoning about their functional parts. In *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, Tokyo Big Sight, Japan, November 3–7 2013.
- [66] Moritz Tenorth, Johannes Ziegltrum, and Michael Beetz. Automated alignment of specifications of everyday manipulation tasks. In *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, Tokyo Big Sight, Japan, November 3–7 2013.
- [67] Dominick Vanthienen, Tinne De Laet, Wilm Decré, Herman Bruyninckx, and Joris De Schutter. Force-Sensorless and Bimanual Human-Robot Comanipulation Implementation using iTaSC. In *Proc. of 10th IFAC Symposium on Robot Control*, pages 832–839, 2012.
- [68] Dominick Vanthienen, Markus Klotzbuecher, Tinne De Laet, Joris De Schutter, and Herman Bruyninckx. Rapid application development of constrained-based task modelling and execution using domain specific languages. In *IEEE/RSJ International Conference on Intelligent Robots and Systems*, pages 1860–1866, 2013.

- [69] Francisco Vina, Yasemin Bekiroglu, Christian Smith, Yiannis Karayiannidis, and Danica Kragic. Predicting slippage and learning manipulation affordances through gaussian process regression. In *IEEE-RAS International Conference on Humanoid Robots*, pages 462–468, 2013.
- [70] Jan Winkler, Georg Bartels, Lorenz Mösenlechner, and Michael Beetz. Knowledge enabled high-level task abstraction and execution. *First Annual Conference for Advances in Cognitive Systems*, 2(1):131–148, December 2012.
- [71] Jan Winkler, Moritz Tenorth, Asil Kaan Bozcuoglu, and Michael Beetz. Cramm – memories for robots performing everyday manipulation activities. In *Second Annual Conference on Advances in Cognitive Systems*, Baltimore, MD, USA, December 2013.
- [72] Lee Youngeun, Sébastien Lengagne, Abderrahmane Kheddar, and J. Kim, Young. Accurate evaluation of a distance function for optimization-based motion planning. In *IROS'12: International Conference on Intelligent Robots and Systems*, volume 1, pages 1513–1518, Vilamoura, Algarve, Portugal, October 2012.

3.2 Accepted for publication

- [73] Don Joven Agravante, Andrea Cherubini, Antoine Bussy, Pierre Gergondet, and Abderrahmane Kheddar. Collaborative Human-Humanoid Carrying Using Vision and Haptic Sensing. In *International Conference on Robotics and Automation (ICRA)*. IEEE, 2014. Accepted for publication.
- [74] Gianni Borghesan, Erwin Aertbeliën, and Joris De Schutter. Constraint- and synergy-based specification of manipulation tasks. In *IEEE Proc. of the Int. Conf. on Robotics and Automation*, 2014. Accepted for publication.
- [75] Gianni Borghesan and Joris De Schutter. Constraint-based specification of hybrid position-impedance-force tasks. In *IEEE Proc. of the Int. Conf. on Robotics and Automation*, 2014. Accepted for publication.
- [76] Miao Li, Hang Yin, Kenji Tahara, and Aude Billard. Learning object-level impedance control for robust grasping and dexterous manipulation. In *Proceedings of the International Conference on Robotics and Automation (ICRA)*, 2014. Accepted for publication.
- [77] A. L. Pais and A. Billard. Encoding bi-manual coordination patterns from human demonstrations. In *Proceedings of the 9th ACM/IEEE International Conference on Human-Robot Interaction (HRI)*, 2014. Accepted for publication.

3.3 Submitted articles under review

- [78] R. de Kleijn, G. Kachergis, and B. Hommel. Beyond pressing keys and grasping objects: The challenges of real-time sequential action control. *Submitted to Frontiers in Neurobotics*, 2013. Under review.

- [79] G. Kachergis, D. Wyatte, R. C. O'Reilly, R. de Kleijn, and B. Hommel. A continuous time neural model for sequential action. *Submitted to Philosophical Transactions of the Royal Society B*, 2013. Under review.
- [80] N. Kyriazis and A. Argyros. Scalable 3d tracking of multiple interacting objects. In *CVPR*, 2014. Under review.
- [81] D. Michel, X. Zabulis, and A. Argyros. Shape from interaction. *Machine Vision and Applications*, 2014. Under review.
- [82] I. Oikonomidis and A. Argyros. Evolutionary quasi-random search for hand articulations tracking. In *CVPR*, 2014. Under review.
- [83] Ana Lucia Pais, Keisuke Umezawa, Yoshihiko Nakamura, and Aude Billard. Task parametrization using continuous constraints extracted from human demonstrations. *Submitted to IEEE Transactions on Robotics.*, 2013. Under review.
- [84] Moritz Tenorth and Michael Beetz. Enabling Robots to Interpret Generalized Task Descriptions using the KnowRob Framework. *Submitted to Artificial Intelligence*, 2014. Under review.